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cinefex

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State of the BUSINESS

a Cinefex 25th anniversary forum

EDITED BY JODY DUNCAN

INTERVIEWS BY DON SHAY, JOE FORDHAM & JODY DUNCAN

As you know if you read our commemorative issue #100 – and if you didn't, shame on you – we celebrated our 25th anniversary of publishing Cinefex with a forum concerning the state of the art of visual effects. After interviewing more than 50 leaders in the visual effects community, we gathered and edited that interview material to construct a simulated 'round-table' discussion that, thanks to the insights of our subjects, was sometimes raucous, sometimes humorous, sometimes controversial, always thought-provoking and illuminating.

Our first draft, which included discussion of the state of the visual effects business, ran so long, it would have consumed the entire issue; and so we made a late-date decision to excise the business discussion and save it for the current issue, now in your hands. While many interview subjects featured in the last issue are included here, we solicited additional commentary from new subjects, as well – people possessing a unique perspective on the business side of visual effects.

The cumulative experience and knowledge of all these luminaries, and their willingness to share their gut-honest observations regarding the state of the visual effects business, has resulted in yet another spirited forum of ideas.

Enjoy.

CINEFEX: The visual effects business has long been recognized as extremely volatile, characterized by high overhead and tiny profit margins.

TIM SARNOFF: Traditionally, it hasn't even been considered a business! The visual effects industry is often called 'an expensive hobby.'

CINEFEX: Why is that? Why is it that this one element of the film business, which is used to sell movies and often accounts for 30 percent of the overall production budget, doesn't work as a business model?

SCOTT ROSS: Part of it is just the culture of visual effects. The visual effects industry is a very frightened industry. Everybody is afraid of losing their jobs, of being the low man on the totem pole, of being the guy that credits after the caterers. Because of that culture of fear, when the client says, 'Jump,' you say, 'How high?'

JIM MORRIS: Also, people are in it for love, not profit. That's what makes this business so special – but also so damn difficult. Profits are not first and foremost in the minds of most effects people. They want to do great work and work on cool projects with great directors. They're in the business because they are passionate about it, because they love doing it.

SCOTT ROSS: And because they are passionate about it, companies will take work just to make payroll. They're not really in the business of making money, or even in the business of being in business. They're in the business of making payroll, crafting good work and getting credits.

CINEFEX: It doesn't sound as if a visual effects company is a very sound investment!

KEVIN HAUG: Anybody who is conned into putting their money into a visual effects company as an investment will always lose it. Nearly every company that has gone down in the past dozen years went down when the investors wanted their money back. They were doing good work, staying just enough above water to buy new equipment and keep payroll going; but the second the venture capitalist wanted his money back, they went bankrupt. This business isn't about making a profit in the sense of venture capitalist profit. Never has been and never will be. It's just about being able to pay your people while you do the work.

CINEFEX: Given the amounts of money the studios make on some of these big effects movies, it doesn't seem right that the visual effects companies have to struggle so hard just to make their payroll.

SCOTT ROSS: Well, that's another problem – the culture of the studios, which has been to hide their profits by calling it 'overhead' or 'distribution fees.' It's a culture that says, 'We're going to do everything we can from an economic point of view to screw people.' If the client base is like that, they assume everyone else is like that. So when we talk about overhead, they attack it immediately. 'Overhead? How dare you?' But, in our case, it really is overhead. It's not profit.

“Profits are not first and foremost in the minds of most effects people... They're in the business because they are passionate about it, because they love doing it.”

JIM MORRIS

TOM WOODRUFF: For us, overhead is truly the physical space. It's the cost of the rental on the shop, the cost of the electric and the gas and the water. It certainly isn't padded. It doesn't even contain our salaries. When Alec and I work on a job, we don't know what we're going to make on that job until it's over. We don't carve aside a certain amount of the budget for our salaries, and lift that out and it's gone. We put as much into the movie as we possibly can; and then, when it's over we say, 'Okay, what's left?' And that's what we're paid.

ALEC GILLIS: We've had producers get irate when we break down our overhead in a budget. They say: 'You're charging us for your building? Are you crazy? We're not going to pay for your overhead!' Well, somebody has to pay for it. We're just being up front with them.

TOM WOODRUFF: And we're not charging them for our overhead when the show is over. We're not jacking up the price to cover us in the down times. Once the show is over, we're digging back into our 'profit' to keep up the shop in between shows, so that we will be here the next time the studio needs us. On some shows, we literally just cover the cost of our labor and our material. Alec and I kick in some of our own money to cover the overhead, because it's not a money-making proposition.

CINEFEX: Then why do you do it? Is it that 'love of the work' thing?

TOM WOODRUFF: Yeah. Some projects are warranted just because of our own interest, because we'd rather do this movie than have someone else do it.

CINEFEX: So, specifically, what are some of the forces working against an effects company being able to make a profit?



Crag Barron

VISUAL EFFECTS SUPERVISOR

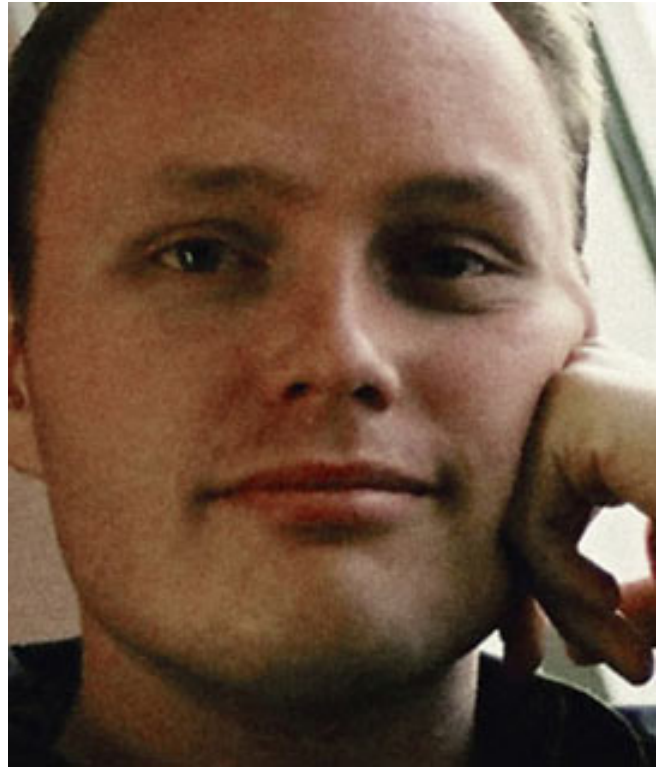
Formed Matte World (now Matte World Digital) in 1988, after eight years in matte department at Industrial Light & Magic. Oscar nomination: Batman Returns. Credits: Independence Day, Casino, Titanic, The Truman Show, Mighty Joe Young, Armageddon, X-Men, Jurassic Park III, Down With Love, The Ring, The Alamo.



Brooke Breton

VISUAL EFFECTS PRODUCER

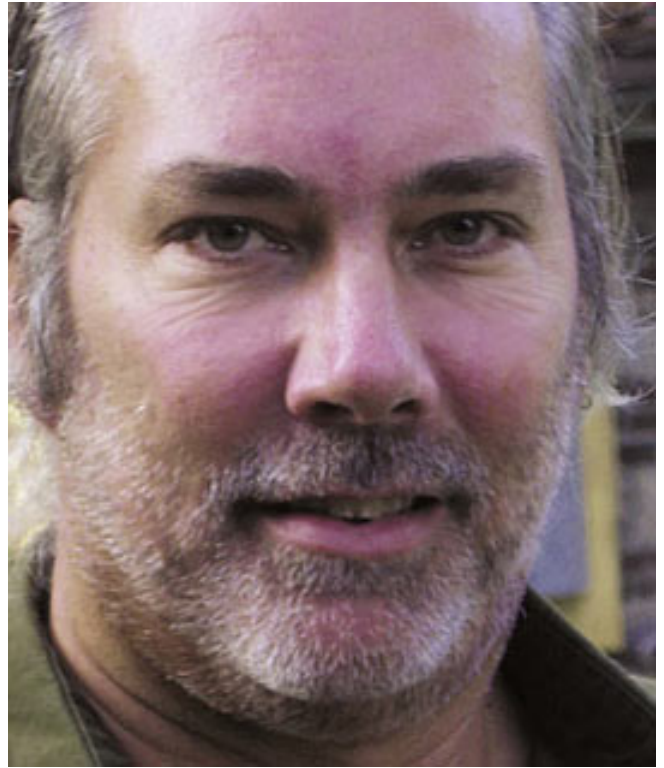
Started career in television postproduction. Was associate producer on Star Trek IV/V/VI, co-producer on Sky Captain and the World of Tomorrow and producer on The Road to El Dorado. Served as senior vice president of production at Digital Domain, 1993-1996. Credits: Dick Tracy, Solaris, Master and Commander.



Stéphane Ceretti

VISUAL EFFECTS SUPERVISOR

With a background in physics and the arts, started as a digital artist at Buf Com-pagnie in 1996. Worked on Batman & Robin and numerous television commercials before advancing to visual effects supervisor on The Cell. Credits: Simone, The Matrix Reloaded, The Matrix Revolutions, Alexander.



Jamie Dixon

VISUAL EFFECTS SUPERVISOR

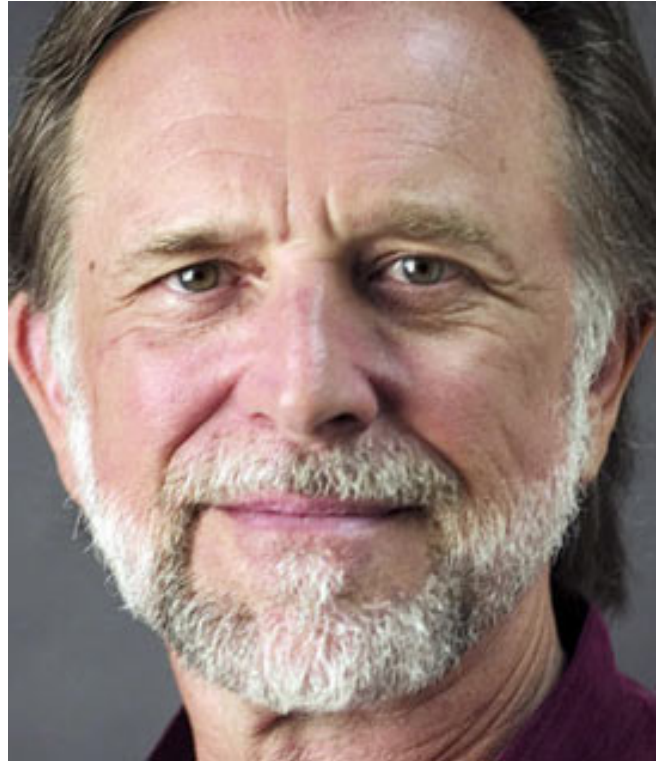
Created some of the first digital film effects at Pacific Data Images, 1985-1995. Founded Hammerhead Productions - with Dan Chuba, Thad Beier and Rebecca Marie - in 1995. Director: Bram Stoker's Shadow builder. Credits: Solar Crisis, Toys, True Lies, Titanic, Deep Blue Sea, Super-nova, The Chronicles of Riddick.



Syd Dutton

VISUAL EFFECTS SUPERVISOR

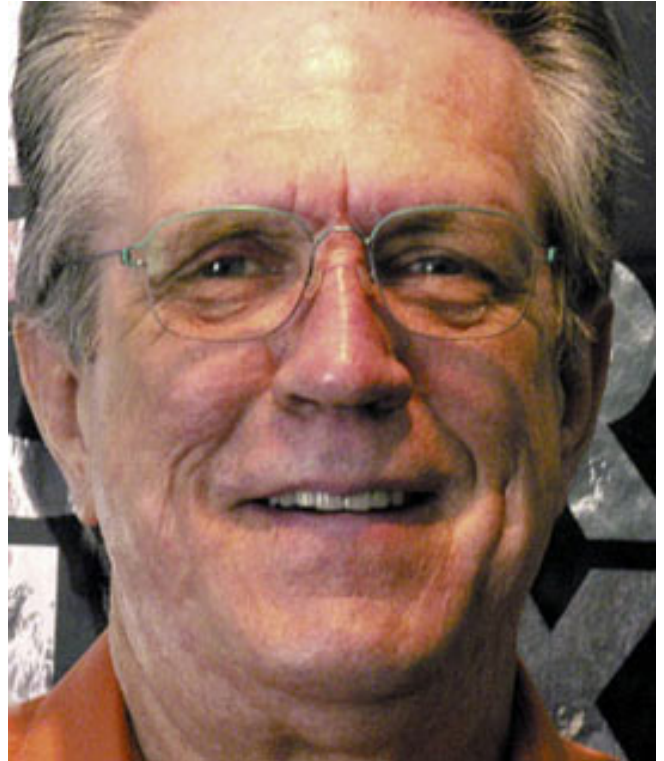
Mastered matte painting under Albert Whitlock at Universal matte department, 1977-1984. When Whitlock retired, founded Illusion Arts, with colleague Bill Taylor, in 1985. Credits: The Hindenberg, Dune, Glory, The Mask of Zorro, The Fast and the Furious, The Time Machine. The Bourne Identity, Van Helsing.



John Dykstra

VISUAL EFFECTS SUPERVISOR

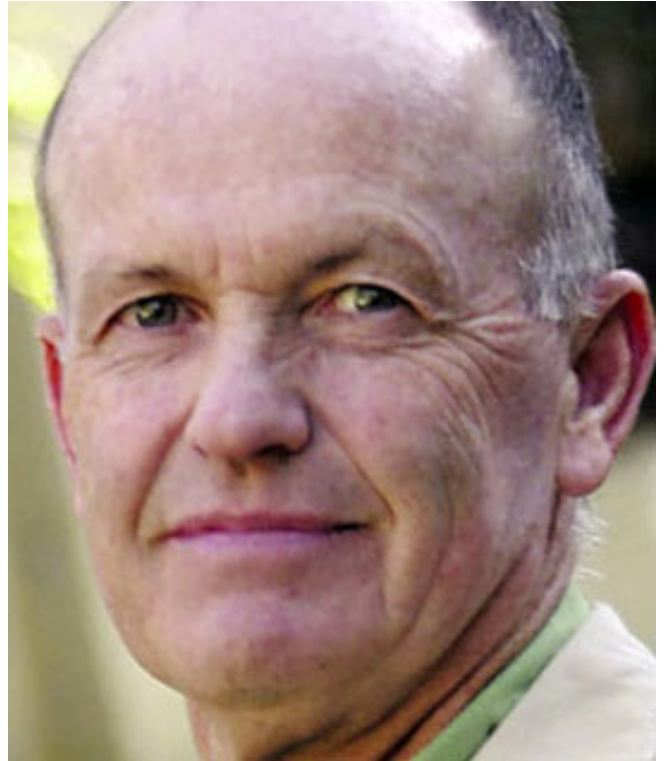
Started career with Douglas Trumbull. Chosen by George Lucas to launch Industrial Light & Magic and supervise Star Wars visual effects. With partners, formed Apogee, 1978-1992. Academy Award: Star Wars. Nominations: Star Trek: The Motion Picture, Stuart Little, Spider-Man, Spider-Man 2. Credits: Batman Forever.



Richard Edlund

VISUAL EFFECTS SUPERVISOR

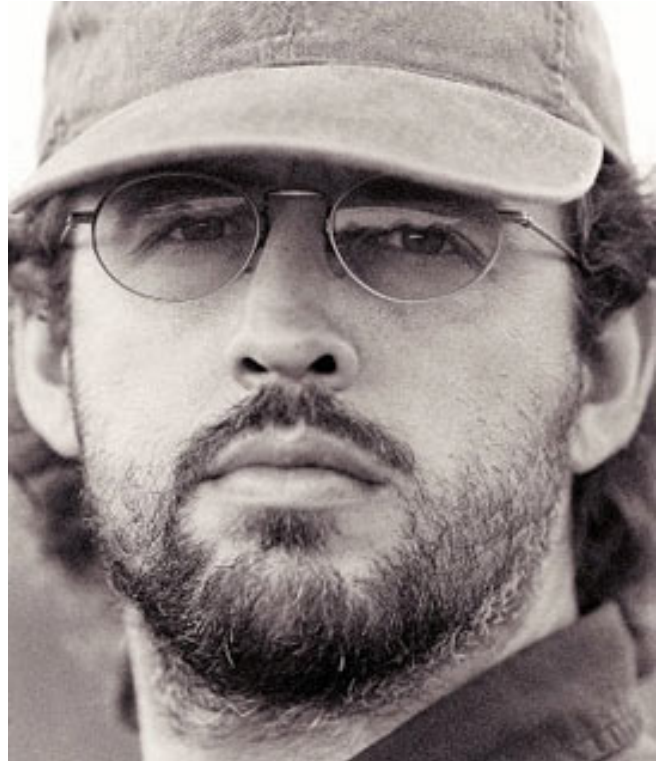
After years with Westheimer Company, Robert Abel & Assoc and ILM, formed Boss Film Studios, 1983-1997. Academy Awards: Star Wars, The Empire Strikes Back, Raiders of the Lost Ark, Return of the Jedi. Nominations: Poltergeist, Ghostbusters, 2010, Poltergeist II, Die Hard, Alien 3. Credits: Cliffhanger, Multiplicity.



Harrison Ellenshaw

VISUAL EFFECTS SUPERVISOR

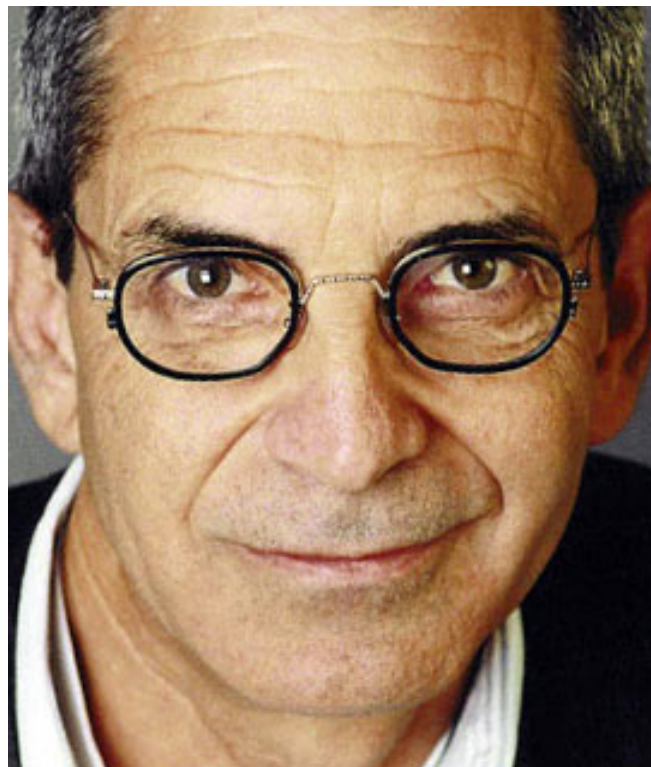
Joined Walt Disney Studios as matte artist, rising to matte department supervisor, 1974-1979. Moon-lighted on Star Wars, then oversaw matte department on The Em-pire Strikes Back. Headed Buena Vista Visual Effects, 1990-1996. Oscar nomination: The Black Hole. Credits: Tron, Superman IV, Ghost, Dick Tracy.



Volker Engel

VISUAL EFFECTS SUPERVISOR

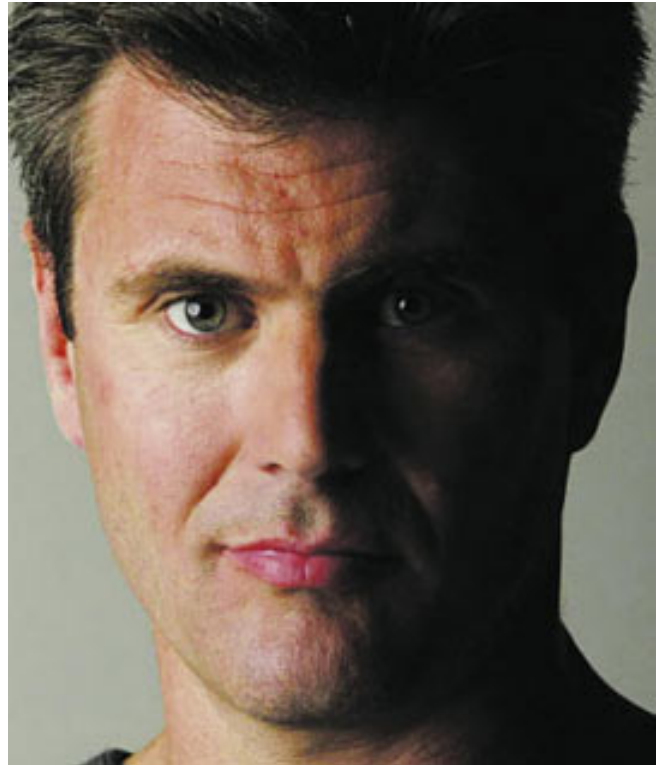
Started career in Germany on Moon 44 and Universal Soldier, then moved to the United States. In 1999, formed production company Uncharted Ter-ri-tories, with Marc Wei-gert, and effects subsidiary Dream-scape Imagery. Academy Award: Inde-pendence Day. Credits: God-zilla, Coronado, Kingdom in Twilight.



Michael Fink

VISUAL EFFECTS SUPERVISOR

Since 1982, has spent most of his career as an independent visual effects supervisor, with periodic senior staff positions at facilities such as Warner Digital Studios, 1995-1997, and Cine--site, 2000-2003. Oscar nomination: Batman Returns. Credits: Lethal Weapon 4, X-Men 1/2, Clockstoppers, 13 Ghosts, Constantine.



Alec Gillis

CREATURE EFFECTS CREATOR

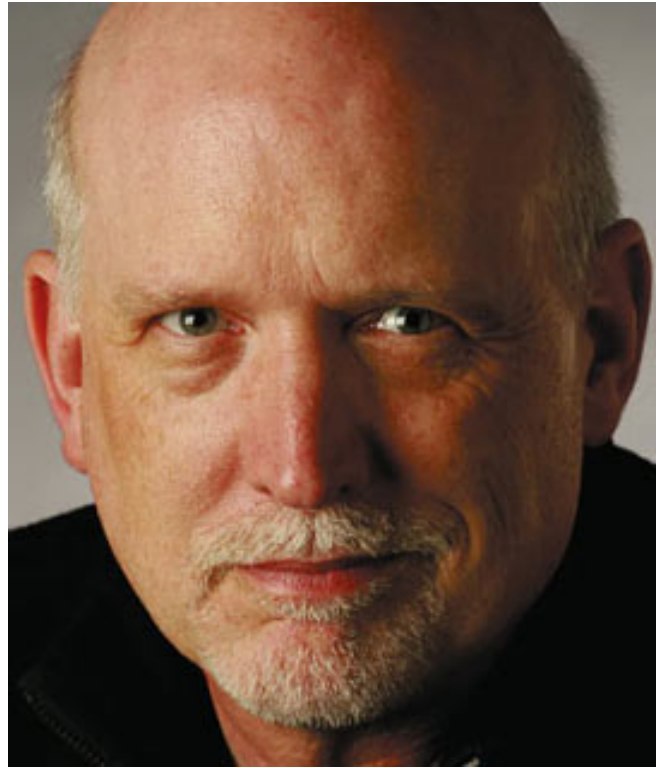
Started as a modelmaker, then did makeup and creature work for Greg Cannom, Tom Savini and Stan Winston. Founded Amalgamated Dynamics Incorporated, with Tom Woodruff, Jr., in 1990. Oscar nominations: Alien 3, Starship Troopers. Credits: Aliens, Tremors, Wolf, Alien Resurrection, Bedazzled, Spider-Man 1/2.



Chris Godfrey

VISUAL EFFECTS SUPERVISOR

Worked in television editing and pioneered in computer animation in Australia. Participated in establishing Discreet Logic. Founded Animal Logic, with Zareh Nalbandian, in 1991. Credits: Mouse Hunt, Babe: Pig in the City, The Thin Red Line, Moulin Rouge, The Fellowship of the Ring, Hero. Upcoming: Stealth.



Ned Gorman

VISUAL EFFECTS PRODUCER

Started in show business as a stage actor. Joined Industrial Light & Magic in 1982 as a production buyer and advanced to visual effects producer. Credits: Ghost, Memoirs of an Invisible Man, The Abyss, Meteor Man, Congo, The Lost World, Star Wars I, Pearl Harbor, Men in Black II. Upcoming: Son of the Mask.



Matthew Gratzner

MINIATURE EFFECTS SUPERVISOR

Freelanced as prop and model builder until 1995 founding of Hunter/Gratzner Industries with Shannon Blake Gans and Ian Hunter - which evolved into New Deal Studios. Credits: Alien Resurrection, Godzilla, The League of Extraordinary Gentlemen, The Forgotten, National Treasure, The Aviator.



Kevin Tod Haug

VISUAL EFFECTS SUPERVISOR

Worked in motion control before shifting into digital production at The Post Group and Propaganda Films. Now independent, specializes in assembling teams of freelancers and small vendors for modest-size films with strong directorial vision. Credits: The Game, Fight Club, The Cell, Panic Room, Finding Neverland.



Richard Hollander

VISUAL EFFECTS SUPERVISOR

Designed motion control systems for Robert Abel & Assoc and Douglas Trumbull. In 1987, co-founded Video Image/VIFX, sold to Rhythm & Hues in 1999. Now president of the R&H film division. Credits: Face/Off, Titanic, Blade, Harry Potter 1, Daredevil, X2: X-Men United, The Cat in the Hat, Garfield, Scooby-Doo 2.



Steve Johnson

SPECIAL EFFECTS DESIGNER

After four years with Rick Baker, headed creature shop at Boss Film Studios before forming XFX - now Edge FX - in 1986. Credits include: Ghostbusters, The Abyss, Species I/II, Men in Black, Sphere, Bicentennial Man, Blade II, The Cat in the Hat, Scooby-Doo 2, The League of Extraordinary Gentlemen, Spider-Man 2.



Van Ling

VISUAL EFFECTS SUPERVISOR

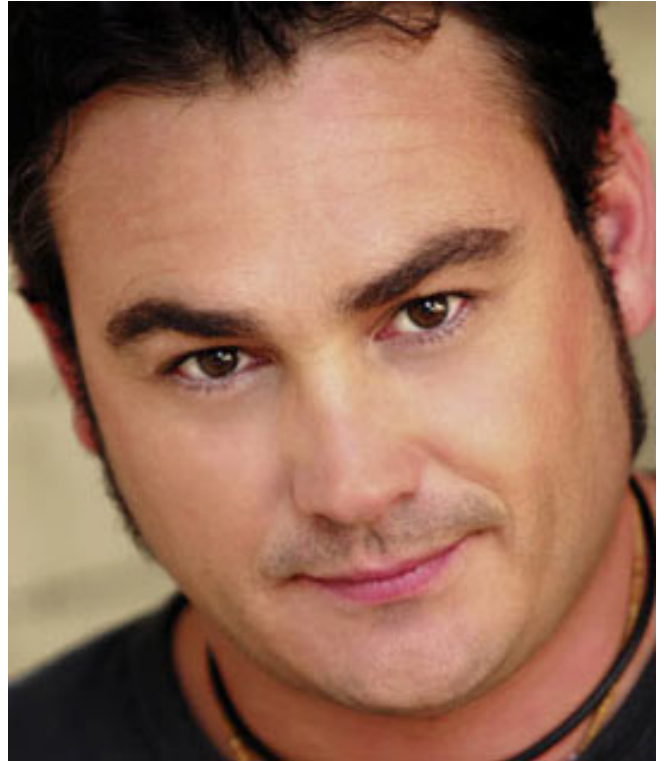
Started career at Lightstorm Entertainment as technical liaison to James Cameron, later head of production. Formed Banned From the Ranch, with Casey Cannon, and served as creative director, 1994-1999. Credits: The Abyss, Terminator 2, Twister, Titanic, Paulie, Doctor Dolittle, Stir of Echoes, Not Another Teen Movie.



Gray Marshall

VISUAL EFFECTS SUPERVISOR

Started career in motion control, then transitioned into digital effects. Worked at Boss Film Studios, then joined Digital Domain, 1994-1997. In 1997, founded Gray Matter FX with Margaux Mackay. Credits: Being John Malkovich, Adaptation, Secret Window, The Life Aquatic With Steve Zissou. Upcoming: Lords of Dogtown.



Nathan McGuinness

VISUAL EFFECTS SUPERVISOR

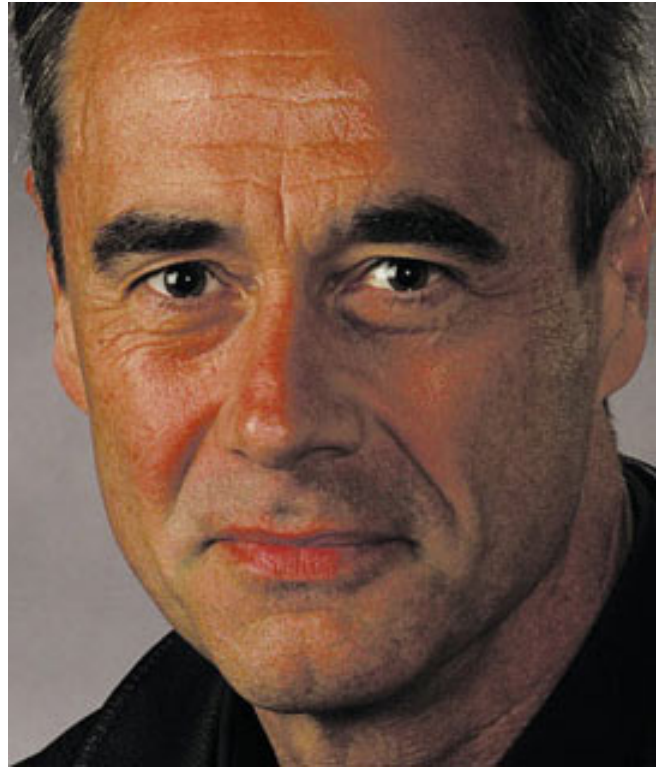
Started career in native Australia. Moved to the United States and joined Planet Blue, 1996-1998. Founded Asylum Visual Effects in 1999. Oscar nomination: Master and Commander. Credits: Moulin Rouge, Behind Enemy Lines, Black Hawk Down, Minority Report, Down With Love, The Phantom of the Opera.



Tim McHugh

VISUAL EFFECTS SUPERVISOR

Began career in 1978. Worked at Entertainment Effects Group, Apogee and Buena Vista Visual Effects. In 1993, founded Area 51, specializing in visual effects for television. Emmy Awards: Dune, Children of Dune. Credits: The X-Files, Space: Above and Beyond, From the Earth to the Moon, Threat Matrix,.



Jim Morris

VISUAL EFFECTS EXECUTIVE

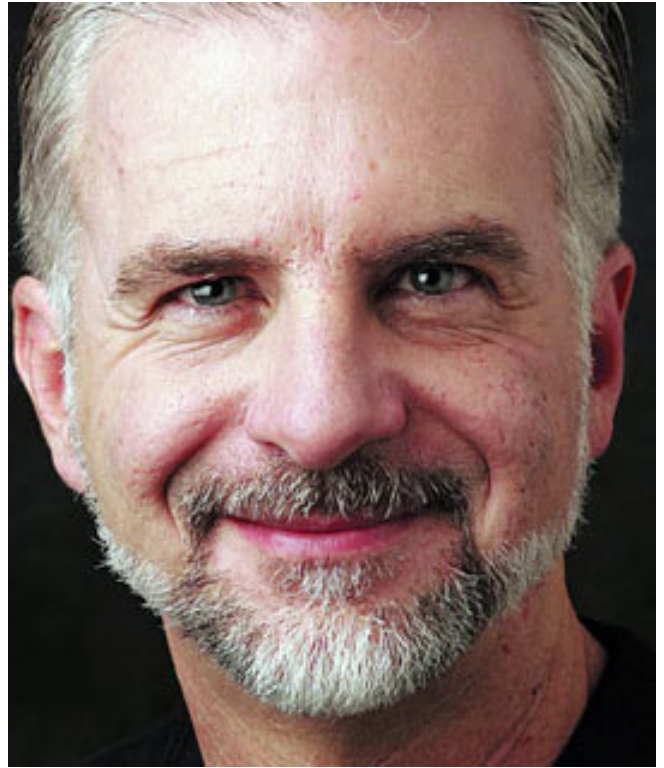
Transitioned from television cameraman and editor into commercial production. Joined Industrial Light & Magic, in 1987, as visual effects producer. Later served as executive in charge of production, then general manager, and finally president of Lucas Digital, through 2004. Now a producer at Pixar Animation Studios.



Jeffrey A. Okun

VISUAL EFFECTS SUPERVISOR

Gained entry into visual effects in the employ of Saul Bass, acting as liaison with numerous optical houses. Began consulting with film studios, then became independent visual effects supervisor. Credits: Star-gate, Cutthroat Island, Sphere, Deep Blue Sea, Red Planet, The Last Samurai. Upcoming: Elizabethtown.



Ken Ralston

VISUAL EFFECTS SUPERVISOR

Started at Cascade Pictures in 1971. After 20 years at Industrial Light & Magic, joined Sony Pictures Imageworks as president in 1995. Academy Awards: The Return of the Jedi, Cocoon, Who Framed Roger Rabbit, Forrest Gump. Credits: Back to the Future I/II/III, Contact, Cast Away, Men in Black II, The Polar Express.



Scott Ross

VISUAL EFFECTS EXECUTIVE

Worked at One Pass Film & Video, starting in mid-1970s, and advanced to CEO. Recruited as general manager of Industrial Light & Magic in 1988, later named vice president of LucasArts Entertainment Group. With James Cameron and Stan Winston, founded Digital Domain in 1993. Now chairman and CEO.



Tim Sarnoff

VISUAL EFFECTS EXECUTIVE

Began career at NBC-TV and Paramount Television. Established television animation unit at Warner Brothers, in 1989, which grew into a separate business entity during his tenure. Named senior vice president of Warner Digital Studios, 1995-1997. Joined Sony Pictures ImageWorks in 1997. Named president in 2002.



Patrick Tatopoulos

CREATURE & PRODUCTION DESIGNER

Spent several years in Italy and Greece doing fine art and illustration before relocating to the United States to pursue career in film. Formed Patrick Tatopoulos Design in 1993. Credits: Stargate, Independence Day, Godzilla, Dark City, Pitch Black, Underworld, Van Helsing, I, Robot. Upcoming: Underworld 2, Rahan.



Bill Taylor

VISUAL EFFECTS SUPERVISOR

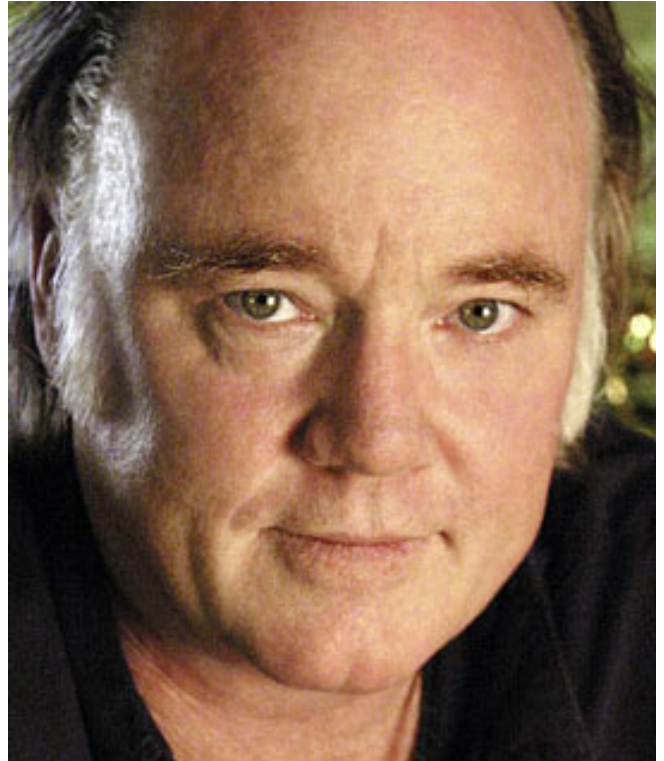
Spent ten years as an optical cameraman, mastering bluescreen photography and compositing under Petro Vlahos. Worked with Linwood Dunn, then Albert Whitlock, 1975-1984. In 1985, formed Illu-sion Arts with Syd Dutton. Credits: The Fast and the Furious, XXX, Star Trek Nemesis, Bruce Almighty, Ladder 49.



Richard Taylor

MAKEUP & CREATURE CREATOR

With Tania Rodger, formed New Zealand special effects company in 1987, which, in partner-ship with Peter Jackson and Jamie Sel-kirk, became Weta Workshop. Academy Awards: The Fellowship of the Ring, The Return of the King. Credits: Heavenly Creatures, The Frighten-ers, The Two Towers. Upcoming: King Kong.



Phil Tippett

VISUAL EFFECTS SUPERVISOR

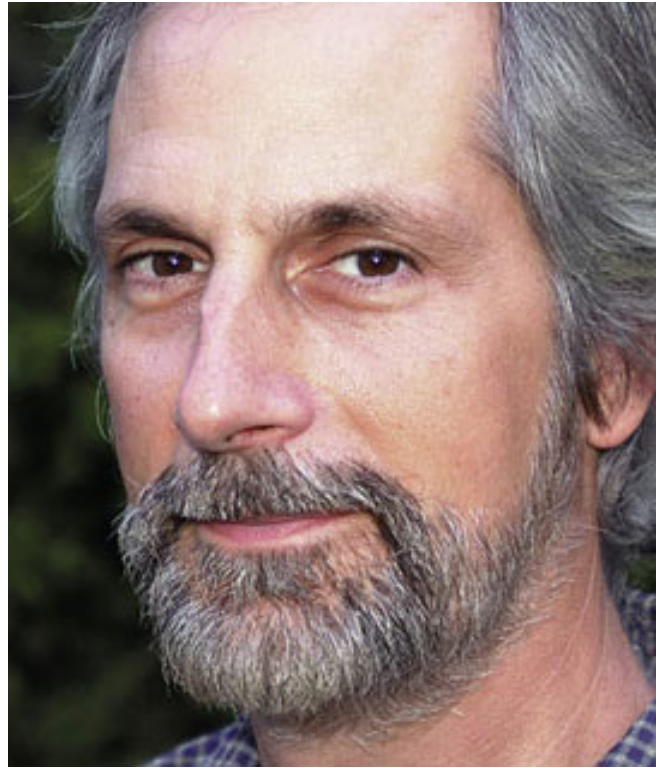
Began as stop-motion animator. Joined Industrial Light & Magic, 1975-1984. Formed Tippett Studio, with Jules Roman and Craig Hayes, in 1985. Director: Starship Troopers 2. Academy Awards: Return of the Jedi, Jurassic Park. Nominations: Dragonslayer, Willow, Dragonheart, Starship Troopers. Credits: RoboCop 1/2/3.



Keith Vanderlaan

VISUAL EFFECTS SUPERVISOR

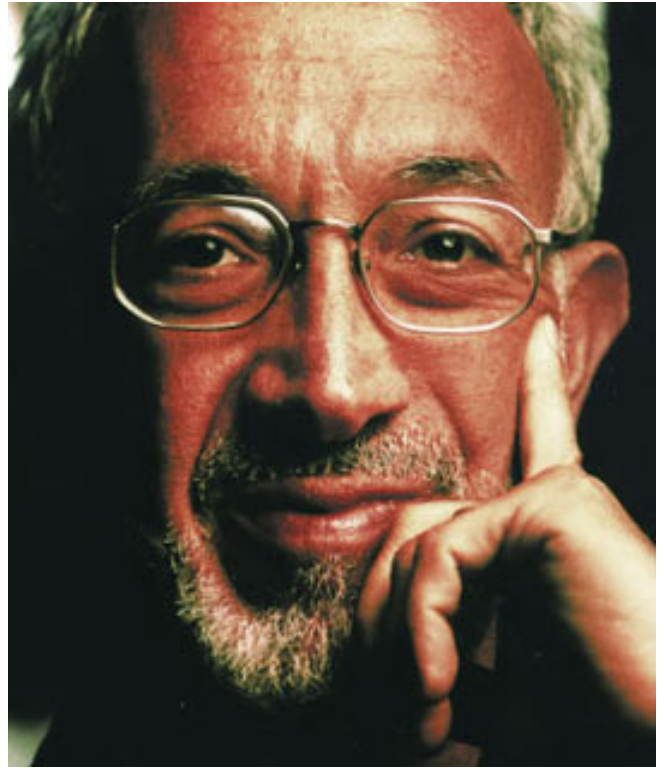
Began career as assistant to Greg Cannom in 1990. Worked as makeup artist and producer at Cannom Creations through 1996. Founded Captive Audience Productions in 1997. Oscar nomination: The Passion of the Christ. Credits: Van Helsing, Pirates of the Caribbean, Son of the Mask. Upcoming: The Exorcism of Emily Rose.



John Van Vliet

VISUAL EFFECTS SUPERVISOR

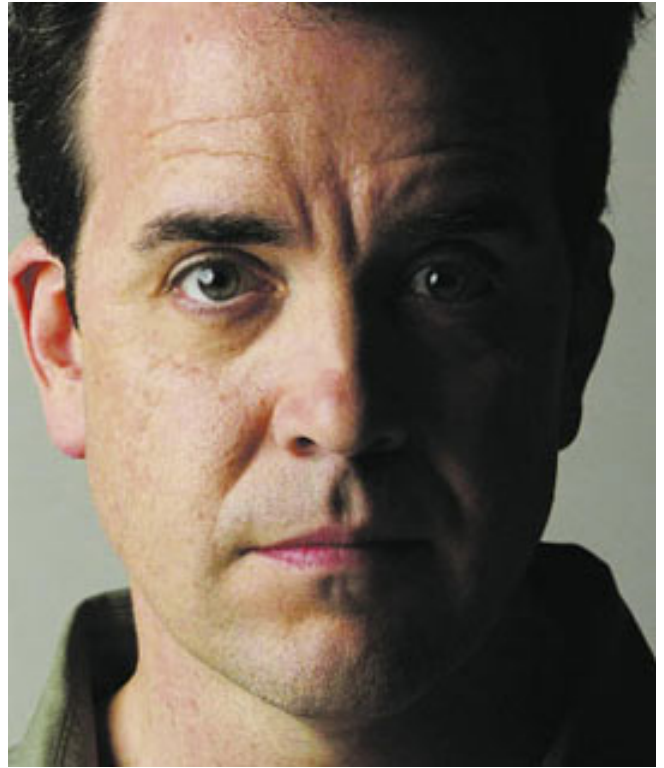
Started as an animator at Industrial Light & Magic, 1979-1981, then joined Disney to work on Tron. Owned and operated Available Light, with partner Katherine Kean, 1983-2000. Now independent. Credits: The Empire Strikes Back, Ghost, Stargate, My Favorite Martian, X-Men, Hart's War. Upcoming: Herbie: Fully Loaded.



Stan Winston

CHARACTER CREATOR

Acting aspirations gave way to makeup and animatronics. Formed Stan Winston Studio in 1981. Director: Pumpkinhead, A Gnome Named Gnorm. Academy Awards: Aliens, Terminator 2, Jurassic Park. Nominations: Heartbeeps, Predator, Edward Scissorhands, Batman Returns, The Lost World, A.I. Upcoming: Zathura.



Tom Woodruff, Jr.

CREATURE EFFECTS CREATOR

Spent six years at Stan Winston Studio, then founded Amalgamated Dynamics Incorporated, with Alec Gillis, in 1990. Academy Award: Death Becomes Her. Nomination: Alien 3. Credits: The Santa Clause 1/2, Jumanji, My Favorite Martian, Hollow Man, The Sixth Day, Evo-lution, Alien Vs. Pred-a-tor. Upcoming: Superman Returns.



Hoyt Yeatman

VISUAL EFFECTS SUPERVISOR

Co-founded Dream Quest Images in 1980. Company acquired by Disney in 1996, renamed The Secret Lab, and shut down in 2001. Launched Whamaphram Productions, with David James, in 2004. Academy Award: The Abyss. Nomination: Mighty Joe Young. Credits: The Fly, Short Circuit, Crimson Tide, Mission to Mars.



"If you get a job, you have to promise to do things you don't know how to do... If you agree only to use mature technology at the beginning of a film that takes two years to produce, at the end of that production, your technology will be two years old and your image will be obsolete."

JOHN DYKSTRA

HOYT YEATMAN: For one thing, running a visual effects company is very much like running a fire department – you have to have everything on standby, because you have no idea what is going to hit your doorstep. That makes it very expensive, to have everyone all wound up, all the airships and tankers ready to go on a moment's notice. On top of that, the technology you devise for one film may not apply to the next one down the road. So, as a business economic model, it's horrendous.

JOHN DYKSTRA: You can make money at it, but it goes in sweeps. To make it, you have to have three or four projects back to back coming into the facility. But that's not how it goes. You'll go on a long climb, and then you'll drop and stay down for a couple of years. But a couple of years, at the burn rate of these facilities, is huge. If you talk to most people who have had these businesses, you learn that the business was incredibly successful one year; but then they burned everything they made that year waiting for six months for the next big project to come in.

CINEFEX: And, throughout that six months, you still have to maintain your facility, your staff.

JOHN DYKSTRA: Yes. You can't even get that next big project unless you have the people and the technology there, ready to go. And the technology and the people have to be updated every year.

CINEFEX: Because there's an expectation that you always be on the cutting edge?

JOHN DYKSTRA: That's right. If you get a job, you have to promise to do things you don't know how to do. It's a prerequisite. If you agree only to use mature technology at the beginning of a film that takes two years to produce, at the end of that production, your technology will be two years old and the image will be obsolete. So you have to look forward, and say, 'What are we going to be doing in two years?' And that's tough. The technology changes so fast, you're really asking, 'What are we going to be doing in 15 years?' You have to make these leaps of faith, because you don't know how you are going to do half this stuff. You're always at risk.

KEN RALSTON That's partly what makes this kind of work so exciting. But it also makes running a business very difficult, because you really can't foresee the future. You project as best you can; but really, your projection is totally bogus.

CHRIS GODFREY: I think the whole future-proofing thing is better now, though. Four years ago, if you made a wrong hardware decision, it could bring down the whole company. These days, you're spreading your load a bit more. But, even so, you still have to have hundreds of renderers, hundreds of software licenses, hundreds of compositing packages and animation packages.

JOHN DYKSTRA: It's a huge capital-drain environment.

MIKE FINK: It's not like the old days when you could buy an optical printer for \$150,000, and that printer would crank out shots for 30 years. And, 30 years later, the printer was actually better than it had been, because you'd made improvements on it; and so, you were making more money off of that printer than you were in the beginning – and you'd paid it off years ago. That's why you could make money in optical effects, where you can't in digital effects. The hardware is better and more powerful, but that just means we can do more. It doesn't mean we

get paid more. We get paid the same amount of money. The price for a composite is pretty much the same as it was years ago.

CINEFEX: Given that you are constantly having to upgrade the technology, how do you keep the lid on software and hardware costs?

SCOTT ROSS: You have to make sure that the choices you make on the technology side are not just the flavor of the day. That happens a lot. Software comes out that is really cool and all your artists are screaming for it. But you can really box yourself in with software choices. Same thing with hardware.

CINEFEX: Let's address personnel. Certainly, one of the challenges of running an effects company is finding – and keeping – talent.

RICHARD HOLLANDER: Oh, yeah. It's the most important thing. The number one issue here at Rhythm & Hues is dealing with the workforce – making sure they are educated, happy and efficient.

JOHN DYKSTRA: One of the problems in doing that, though, are those up and down periods of work I was talking about. When you are in one of your down times, your creative people go, 'Uh, we're not doing anything.' And you say, 'Yeah, but I'm still paying you!' And they say, 'Sorry – I've got to do something.' And they'll take a job for less money in order to do something that's exciting. You have to be doing the kind of work that draws the talent. The talent isn't going to come if you're doing boring work.

CINEFEX: To what extent does salary come into play in keeping your people happy?

SCOTT ROSS: Well, you have to pay folks a competitive salary, of course. Unfortunately, some companies are prepared to spend whatever it takes to get people. And once you get into that desperation mode – 'I need five people to do rotoscoping, and I'm prepared to pay whatever it takes' – you are putting yourself on a very slippery slope. There's a fine line there, offering a competitive salary and an environment that artists can feel supported in; but at the same time, you have to maintain a salary base. If you just pay people what the market is paying – and at times, the market is ridiculous – you'll go out of business.

ALEC GILLIS: Ten years ago, I remember hearing about the digital companies being so ravenous for new personnel, they took a car park attendant, taught him animation – and a week later, he was suddenly making \$1,500 a week! That desperation to grab people is partly what jacked up the cost of salaries; and the digital effects companies are living with that today.

CINEFEX: There is also the problem of hiring people and training them, only to have them go off and work somewhere else.

PHIL TIPPETT: Studios our size, in particular, are like training facilities. People see our studio as a stepping stone to a career, to other places. It's a difficulty. In your job search and interviews, you have to try to find people who are philosophically minded and want a certain lifestyle and want to work in a particular kind of way. That way, just by gravitational attraction, you get a core group of people that you want, people who are extremely reliable and who stay with you. You are always going to have people that come and go; and it is always frustrating to

train somebody, and then see them go off and train the competition somewhere else. But there's nothing you can do about that.

SCOTT ROSS: I'm not president of Digital Domain anymore; but when I was, I had a real hard time dealing with that. I'd find some guy who was a set painter, and I'd build his career over a number of years, and he'd win an Academy Award, and I'd be one of his close friends – and then one day he walks into my office, and says: 'Guess what? X company just doubled my salary. Bye!' It's part of the business, but that was very difficult, very emotional for me.

CINEFEX: We've heard there's some pretty aggressive headhunting that goes on. What are some of your strategies to keep your talent from leaving?

MATTHEW GRATZNER: We treat our crew really well. The problem with film production is that it really burns out people. But we can't do that. We can't push our crew to the limits on every job. You can only do three or four jobs like that before it all starts falling apart. We need our people to stay with us, long-term.

JAMIE DIXON: At Hammerhead, we treat our people fantastically. They are given a great environment to work in. We give them lunch. We get their cars washed. There's a swimming pool here. One of the things we recognized is that people are going to work their asses off when they're here, and it doesn't cost that much more to treat them well and make the work environment pleasant.

"Studios our size, in particular, are like training facilities. People see our studio as a stepping stone to a career, to other places... It is always frustrating to train somebody, and then see them go off and train the competition somewhere else."

PHIL TIPPETT

TIM SARNOFF: I think career growth is another issue in keeping people happy – allowing them to work on films that are different from one another, so they don't get bored doing the same thing over and over again. At Imageworks, we have a lot of different types of projects going in the facility at the same time, so people have the opportunity to work on either a CG film or a photorealistic, live-action, visual effects style film. There's a lot of migration from one division to another, and that keeps them interested in the work. We also have a training department that works five days a week, eight hours a day, training the artists. And there is nobody in this company who doesn't go through that curriculum. It is essentially a school that keeps people's skill sets up. We have a mentoring system, as well, that allows people to work with Academy-Award-winning supervisors and designers.

CINEFEX: Because of the ebb and flow of the work, most facilities tend to maintain a core group, then expand and contract that workforce as needed. That's pretty typical, isn't it?

GRAY MARSHALL: Yeah. We have people that we work with often and as much as possible; but in between projects, if there's not much going on, we let people go. We make that model work, rather than keeping a full-time staff.

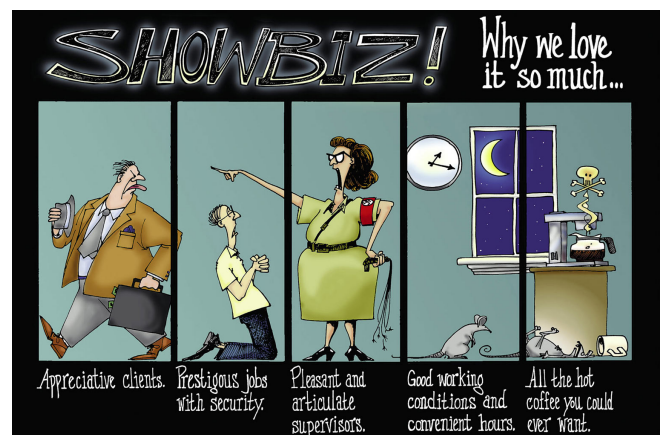
PATRICK TATOPOULOS: I've got a very small core team of maybe seven people. I've got a shop supervisor, my accounting department. It's very tiny. As soon as we get a show, we hire the big team. But that small core is enough to maintain life within the shop between shows.

JAMIE DIXON: It's just a matter of modeling yourself like a traditional production company, where you staff up for the show, and then you're done. In the pyramid of freelance talent out there, there is a 'Hammerhead' wedge that we bring in all the time. And then they're happy to be gone when the show is done, to go off and take their vacations. The other thing that makes a difference is that we - the partners - do a lot of shots ourselves. So on smaller shows, we don't need a lot of extra help.

ALEC GILLIS: The joke of our name, Amalgamated Dynamics, is that it sounds like this big corporation. But, really, Tom and I are the only permanent employees of ADI. Fortunately, we've been able to keep a group of about ten people together over the last 12 to 15 years. It has been important to keep that group, because you develop a shorthand communication with people that have been together a long time. We're all drawing off of mutual experience every time we go into a project. We know people's strengths and weaknesses, and we can capitalize on their strengths and work around their weaknesses. I think that is an aspect to this work that not all producers get. Often we will hear a producer say, 'I don't know if I'm going to go with an established company, or if we'll just rent a warehouse and fill it with talented people.' The problem with that, of course, is that the warehouse is empty, and so you're going to have to spend a lot of money on equipment, and you're going to have to fill it with those talented people. But how well will those talented people interact? And who's going to be in charge of them?

CINEFEX: We've touched a bit on the cyclical nature of visual effects work and movie production, in general. That must be one of the major forces working against the viability of an effects company.

JIM MORRIS: It is. Most big effects movies come out in the spring and summer. So you've got a huge late-winter spike in terms of the work, and then it falls off pretty dramatically because there are not enough holiday and Christmas movies out there to keep us working. Given the slim margins, any dip in utilization has a huge, pronounced backlash. So we work very hard to line up projects that will keep our utilization as flat as possible. Keeping the pipeline loaded is probably the single biggest challenge in the effects business today.



"Given the slim margins, any dip in utilization has a huge, pronounced backlash... Keeping the pipeline loaded is probably the single biggest challenge in the effects business today."

JIM MORRIS

CINEFEX: So how do you do that? How do you keep your pipeline loaded?

RICHARD HOLLANDER: Diversity is essential. If you're growing one crop, and that crop goes dead on you, your entire business is dead. You have to be sufficiently good in many different areas to pull in some kind of cash flow. That's number one.

RICHARD TAYLOR: One of the things we appreciated many years ago was that we were trying to run a high-end, creative effects facility in one of the smallest countries in the world, and as

far away from the core of the industry as you can get. So, from the outset, that meant we had to have a level of diversity in our work. Had we chosen to just be prosthetic makeup effects guys or to just do creatures, we would have quickly fallen off the rollercoaster, because the chances of that work being available all the time are limited. So we set up a facility that contained a number of departments, doing design, fabrication and on-set operation of special makeup effects and prosthetics, armor, weapons, creatures, miniatures and digital effects. We also made the decision that we wouldn't just cater to film and television, that we would do anything from a children's playground to museums to street parades, if the work was creative and rewarding. We knew that, to survive, we had to be as diverse as possible.

NATHAN McGUINNESS: You have to cover a lot of different areas – the commercial industry, the film industry, the main title industry, the design industry. I've always done that at Asylum. I've gone out and found little client bases coming from left, right, top and bottom. And what I find is that as one area goes down, other things come up. I'll start getting commercials as films slow down. I'll start getting main title sequences, and then suddenly I have movie scripts to break down again. We're always busy.

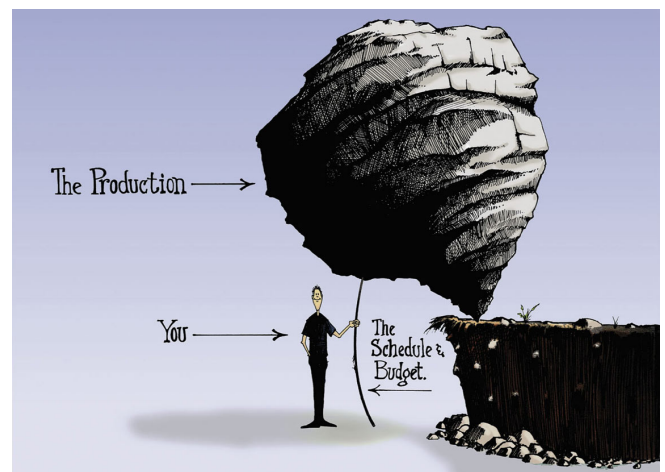
MATTHEW GRATZNER: Diversifying into other things is partly how we have stayed in business. We do commercials in addition to features. Because we're known for doing design work, we might design and build sets, miniatures and props for a commercial. We've also added a digital division, setting up a couple of workstations and a pipeline.

CINEFEX: That's something that a lot of the creature effects facilities are doing, as well – branching out into digital and other areas of visual effects. Captive Audience has done so recently. Stan Winston Digital has been up and running for a while. It does make sense to have live creature effects and digital creature effects under the same roof.

STAN WINSTON: It makes all the sense in the world. The M.O. of Stan Winston Digital is to do digital character and creature effects that complement the live work that we do. Of course, in order for us to survive, we also have to do every other kind of digital effect. So we're doing compositing, we're doing matte paintings. We're doing everything because you can't just wait for the job that is exactly what you want to do. You have to pay the bills.

KEITH VANDERLAAN: When we decided to expand, we actually didn't mean to get into certain aspects of the visual effects industry. I wanted to lean more toward visual effects as it relates to makeup effects. But, somehow, we wound up doing miniatures and models and matte paintings and things like that – and it's all been very exciting. As with all creative processes, you have to keep pushing the envelope. If you're not pushing the envelope, you're stagnating.

CINEFEX: Richard, you came to this earlier than others in the industry. Weta has been both a



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physical effects facility and a digital effects facility for more than a decade now.

RICHARD TAYLOR: Yes. We were always confident that digital effects would ultimately complement the more traditional effects in the film industry, and that there would be a beautiful marriage of all techniques. So, eleven years ago, we bought our first Silicon Graphics machine. We could appreciate, even with the purchase of that first machine, that if we wanted to make the movies we aspired to make, we'd have to support and invest in digital technology.

CINEFEX: How does a traditional effects company go about staffing as you expand into these other areas? Do you hire dedicated computer artists who work on the other side of the wall from your creature and makeup effects people? Or does everybody do everything?

RICHARD TAYLOR: The technicians we contract have to be willing to work in any department. If we haven't got any prosthetics work at one time, our prosthetic technicians will become armor makers or miniature builders. And, in the past two years, we've started teaching a lot of our technicians digital artistry, so that they can have the core skills of a digital technician and complement their craft in those departments, as well.

STAN WINSTON: The painters and sculptors that have been with me at the studio doing live-action animatronic work for a long time are now the very best people I have sculpting and painting in the computer. They've used a pencil before they used a mouse. They used clay before they used a matrix. They are just using the digital tool as a new kind of paintbrush.

KEITH VANDERLAAN: I tend to find people who are multi-talented – sculptors who know how to paint, moldmakers who know how to sculpt, digital effects artists who also understand how to construct miniatures. Hiring a person whose area of expertise lies in one area and one area only doesn't seem advantageous to me, not only because of the way that affects my company, but because it makes the individual stagnate very quickly. A lot of people don't want to do the same job over and over again. I try to create an environment here where there is a constant flow of enthusiasm and excitement, where people feel they can come and really redefine their own boundaries and learn new things. For example, now that we've branched into visual effects, I'm spending a lot of time with my illustrators and sculptors, having them learn basic effects programs, whether it be Maya or Shake or After Effects. Talent is talent. To take one of our Photoshop artists and put him through visual effects training on Maya or Shake or Inferno – that, to me, is a very good investment.

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SCOTT ROSS



"The studio's position, more often than not, is going to be, 'Let's take it to the people who can deliver the work for the cheapest price.' But we in the big companies pride ourselves on quality, rather than being the cheapest place to go."

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CINEFEX: Are there other ways in which creature and makeup effects facilities can diversify, to better survive in this increasingly digital business?

PATRICK TATOPOULOS: Part of my strategy for keeping my shop going has been to look for projects where I can be the production designer for the movie, as well as design the creatures. I did that on Independence Day and on I, Robot, and I'm doing it on Underworld 2 now. When I can find that package, that is an ideal situation.

STEVE JOHNSON: We're gearing our whole business more toward a design studio. And I'm really excited about it. The idea is, let's put aside how the characters will be created - come to us and we will design the best character you've ever seen for your film. There's a great need for character designers to design characters. Even if that character is never made in the real world, there is still a need for all of that creative juice flowing into what it should look like, what it would do. And we'll do that, working in every medium. What's great about that is we will finally be able to take that middle road between practical and digital effects. We won't be fighting for things to be done animatronically, if they shouldn't be. And the digital people won't be saying, 'It should all be digital,' even though it shouldn't be. We'll be doing it all.

CINEFEX: Getting back to keeping the pipeline loaded - I would assume an important factor in keeping feature work coming in is developing relationships with directors and producers. You don't see Steven Spielberg shopping around town. When he has a visual effects show, he goes to ILM, largely because he has a long history with ILM.

SCOTT ROSS: When you're one of the big companies, especially, it's all about the director. The studio's position, more often than not, is going to be, 'Let's take it to the people who can deliver the work for the cheapest price.' But we in the big companies pride ourselves on quality, rather than being the cheapest place to go. A-marquee directors are the only people who can really push the studio, and say, 'Okay, we understand budget, but we have this other thing called quality, and we want art on the screen.' At Digital Domain, we've got Ron Howard and Rob Cohen doing that for us. And ILM has dozens of those relationships with directors because they started so long ago.

JIM MORRIS: People like to work with people with whom they have a trust and a comfort level. Once they've worked with someone, and gotten what they needed for their movie, they want to come back and work with that person again. We've had the good fortune to have an extremely high level of return clients. And we attend to those relationships very carefully. Of course, we also have to constantly be looking for new directors with whom we can build that type of relationship. A stature director, especially, is very important in the decision process.

CINEFEX: How do you go about building that relationship with the director? How do you ensure he wants to come back and use you again?

SCOTT ROSS: We remain as filmmaker-friendly as possible. We allow the filmmaker to make the best creative choices he can make, and not hit him upside the head with change orders every time he takes a breath. We try to give him freedom, to allow him to interrelate with the artists on a real-time basis, and not keep him away from the actual work.

NATHAN McGUINNESS: That's important. I always make sure our creative people work with the director one on one. Michael Bay will walk into Asylum as if it is his own. Joel Schumacher will walk in and talk to the individual artist and call him by his first name. Direct communication with the filmmakers, that's what makes it successful. Supervisors are there for quality control. But when the director wants to talk specifically about a shot, it's best to speak to the artist directly.

CINEFEX: I can see where director relationships would be crucial to keeping feature work coming in. What about commercials as a means of stabilizing the ebb and flow of that feature work? Are commercials a reliable source of income?

GRAY MARSHALL: We've done ten or fifteen commercials, but we're not really pursuing that line of work now. Because my partner and I both came out of the commercial division at Digital Domain, when we first set up, we expected to be doing more commercial work than feature – but it didn't pan out that way. 'Beware the business model, my son.' We ended up doing a lot more features, which was really what we wanted to do in the first place. We prefer the give and take of the feature world to the take and take of the commercial world.

CINEFEX: Even the commercial world must have peaks and valleys in terms of the amount of work that is available.

SCOTT ROSS: Sure. The commercials marketplace definitely has had its ups and downs. I think we've survived that, in part, because rather than going into the commercials directorial business, as so many visual effects companies did, we just created a commercial division and built great relationships with established commercial directors.

CINEFEX: So, at Digital Domain, you don't have in-house commercial directors like ILM did when its commercial division was still operating?

SCOTT ROSS: Right. When Jim Morris and I launched the commercial division at ILM, one of the reasons we did it was to level out the peaks and valleys of our revenue stream. But the other reason was to create opportunities for a bunch of really talented guys who wanted to direct. We didn't do that at Digital Domain. We recognized that directors in the commercial marketplace were going to drive the projects, much like directors in the feature film marketplace. So, if we work with outside directors in the feature film marketplace, we should probably work with outside directors in the commercial marketplace. And that's been good for us.

CINEFEX: Another revenue-producing strategy that effects companies have tried is to get into game production. Is that a workable idea?

SCOTT ROSS: It can be. At Digital Domain, we put together a business deal with Mattel that made us co-owners of the content in the videogame we made – 'Barbie Fashion Designer.' That was the reason we went into that business – we were looking for an opportunity to be an owner, which the movie studios were not going to allow. So we went into the games industry. And we were lucky that we came up with an idea for a game that was a huge hit. But, ultimately, we got out of the business because we couldn't replicate that business deal with anybody else. Everyone said: 'Yeah, that was a great game, and we want to be in business with you – but

you're going to be a vendor, and you're not going to own anything.' Well, we were already in the vendor business. We were in the high-dollar vendor business, in fact, and we didn't want to be in the low-dollar vendor business. So we got out of it.

"We realized a long time ago that we're a service business, and everything that we do is to service someone else's dream... So we've known for a long time that if we were to grow as a company, we needed to be able to commercialize our own intellectual property rights."

RICHARD TAYLOR

CINEFEX: There seems to be a feeling among some companies that getting into production is the way to insulate yourself from the ups and downs of visual effects. What are your thoughts on that idea?

NATHAN McGUINNESS: For a smaller company, like us, it's overreaching. We're just trying to be the very best we can be at doing visual effects, and it's important that we focus only on that.

RICHARD TAYLOR: We realized a long time ago that we're a service business, and everything that we do is to service someone else's dream. Every job we do, we're invited to play with the director's train set - it's not our own train set. So we've known for a long time that if we were to grow as a company, we needed to be able to commercialize our own intellectual property rights. We've been developing our own television production company, and to date we've pitched 13 shows to North America. One of them recently has been given the greenlight; and we are now building our own stand-alone children's television production facility to begin making this show. The intent, of course, is to build an intellectual property rights market - and if it is successful, merchandising, as well. It is, at last, our own train set. What that will do, hopefully, is give us an auxiliary revenue stream that can support the filmmaking entity of our company through the low patches.

KEITH VANDERLAAN: Getting into production is the next logical step for us. But I don't want to become a makeup effects facility that ventures into production of makeup-effects-related films. And I don't want to become a visual effects company that ventures into production of visual-effects-related films. I want to be a filmmaker who has a makeup effects facility and a visual effects facility available to him. The long-term plan is to develop projects, whether they contain visual effects and makeup effects or not. The idea is to produce those films and use the available facilities as needed. I'm patient, and I really don't want to do it unless it's right. And, who knows? That may mean it never happens. But I don't plan to do whatever comes my way just to produce a film. I want to wait for the right thing. If it's a love story that has no visual effects - great. If it's a giant monster movie, and the script is right and the director is right, that would be great, too.

SCOTT ROSS: On a creative level, getting into production was something I always wanted to do. I went to film school and got into this business because I wanted to direct. And somewhere deep in my psyche, I still want to. So there is that personal side of getting into production. On a business level, I see getting into production as the only financial way out. A lot of people say, 'Well, production's a tough business, too.' And that's true. But all businesses are tough.

CINEFEX: At least in production, you have a chance at a home run. You're never going to get a home run doing visual effects.

SCOTT ROSS: You'll never get a single doing visual effects! You're lucky you don't get hit by the pitch. That's what you do in visual effects. You stand at the plate and duck pitches, fouling them off for as long as you can. So, both creatively and financially, production is really the only path to go down.

CINEFEX: Volker, you've ventured into this by co-creating Uncharted Territories, which is both an effects and a production entity.

VOLKER ENGEL: We changed the whole concept. We either develop a project ourselves or, if there is another production entity, we give them a very transparent budget, with no mark-up – which they like. We pay all our artists that way, and then the profit we make is from the producer's fee.

CINEFEX: So, as producers, you actually co-develop projects from the earliest stages?

VOLKER ENGEL: Yes, and that saves money, because we can say: 'Okay, you have this passage in the script and it takes place on the water – could it take place on land? Because that will save you \$100,000 per shooting day.' We can solve problems like that, up front, that sometimes other producers and writers don't even realize are problems. We've also cut out all the middle-management. We have one to three project managers, and, if necessary, a sequence supervisor. It's really us as producers/visual effects supervisors working directly with the artists as much as we can.

CINEFEX: Getting into production sounds promising; and yet, some initial attempts haven't been successful.

JIM MORRIS: That's because some people naively think that the production business is somehow easier than the effects business. But I don't think that's true. I think making a successful enterprise out of making movies is hard. And not all of us in the effects business, necessarily, are trained or have the personality or skill sets to actually be filmmakers.

SCOTT ROSS: A lot of companies have gone about it the wrong way, by taking people from within the existing company and making them filmmakers and story developers. I think you need to find people who have had that experience, who have worked as development executives at a studio, worked as agents, who really know that world, and let them develop properties. But a lot of companies just pulled a group of five or ten people out of their existing facility, and said, 'Okay, you're now the development group.' That's like saying 'You're now the visual effects supervisor' to a development exec.

KEN RALSTON We're lucky here at Sony in that we've got the connection with a real studio, and we've always been intertwined with production. So I'm happy with how things are going here, in that regard. As far as blurring the line between effects and production – blur it! Let's blur the hell out of those lines. Why stay status quo? That's dull.

CINEFEX: Intuitively, it seems as if visual effects companies would be especially suited to producing CG-animated movies. The technical skill sets are the same.

JIM MORRIS: But there are fundamental differences between making an animated movie and making a visual effects movie. I'm not sure that the two things merge as tidily as people would hope. That's why, after several years of incubating those activities at ILM, we made a company decision that it didn't work for us. We needed to set up a separate shingle, Lucasfilm Animation, which is a production company. They can use us as a facility. They can set up their own facility. They can use the facility in Singapore. They can do whatever they want. I think that's a better way to go about it.

CINEFEX: Sony Imageworks is developing animated features. I assume the appeal of that is to create proprietary characters that resonate on an artistic and a financial level. You want to invent Mickey Mouse, as opposed to providing Mickey Mouse for Walt Disney.

TIM SARNOFF: The goal is to create characters that have longevity and are marketable and franchisable and brandable. It's an amazing business to create characters. Characters live forever. There is nothing in any other industry I can think of that lives forever. There's no everlasting shoe or tire; but there are everlasting characters. It's the best business in the world, and Sony wants to be in it.

RICHARD EDLUND The way you get rich in this town is not to run a gas station, which is what visual effects has been. It's basically a service organization. We detail your car for you, then we get a hearty handclasp, thank you very much, and off they go. You have to own it. It has to be your property. Without the benefits of intellectual property, it doesn't make sense to be in this business.

KEN RALSTON It's true that money is the main reason everyone is trying to do this animated feature thing. But, even as artists, it's a great way to go. For animators and designers, to create entire worlds and do all of the work from scratch is a really interesting form of the medium. It's like painting your own painting, even though you have a hundred people holding onto your brush. It's more artistically satisfying than blowing up a planet - although that can be fun, too.

CINEFEX: Despite all of its inherent difficulties, some of you company owners have been in the business for ten, twenty years, or more. How have you managed to survive, when so many others haven't? What is the paradigm for a successful visual effects business today?

"The goal is to create characters that have longevity and are marketable and franchisable and brandable... Characters live forever. There is nothing in any other industry I can think of that lives forever."

TIM SARNOFF

RICHARD TAYLOR: It's hard to answer that, because we ride the same rollercoaster as everyone else in the industry. Just like everybody, we're holding on by our fingernails. But I'd have to say that you can only win in this business if you are constantly pushing the growth of your work and the artistry of the craft. That requires a great deal of passion from the people within the company. It also requires remaining flexible and receptive to the changing needs of the industry.

TIM McHUGH: I think to have a successful visual effects company you just have to work faster, cheaper and smarter. Another way to avoid the minefield is to own your company outright. I

don't have any partners – I never have. And that allows me the freedom to skate the course I want to go down, because I haven't had to answer to shareholders and partners.

SYD DUTTON: That was part of our business model, as well, to not have backers or anything like that. We also kept it to only two partners – me and Bill Taylor – and we agreed early on that we would both have to approve of something before we did it. That's been an important part of our success. You get too many partners, things can collapse in paralysis. That's happened to effects companies that aren't with us any more.

TIM McHUGH: A lot of companies failed because of that – a few people got into business together, and within a short amount of time, they wanted to kill one another. When you have a group of people with different ideas, aspirations and needs, you're going to have a volatile situation at some point – and some companies just couldn't hold it together.

SYD DUTTON: Another thing we do is avoid going into debt and not let our customers owe us money. Our business model is really very simple: no debt, no receivables. We try to get our money as soon as possible.

BILL TAYLOR: Part of the recipe for longevity, too, seems to be choosing one thing you do really well – like matte paintings, in our case – and make that the focus of your business.

CRAIG BARRON: I think we've been successful where others haven't because of that – focusing on what we do best, versus having so much at stake that we have to take on any project, just to keep our doors open. Personally, I wouldn't be interested in working in that kind of environment.

CINEFEX: You're talking about carving out a very specific niche in the industry?

PHIL TIPPETT: That's certainly the way we operate. We're known for character animation. The most satisfying thing is when a director comes to us as a clear casting decision – 'We want you to do this because you're suited to do it.' Otherwise, it's just a cattle call, and the decision is made based on the bottom line, whether or not we can come in under the competition.

CINEFEX: New Deal Studios is another 'niche' company, in that you're known almost exclusively for building and shooting models.

MATTHEW GRATZNER: Right. But another reason we've been successful, I think, is that we've run it like a real business. Shannon Gans, our third partner, handles all the business side, and she runs a really tight ship. The film business, overall, is not really run like a business. We've always joked that if we ran New Deal Studios the way studios run film production, we'd be out of business in a week! There's so much slop and waste in film production. But our business is



"The film business, overall, is not really run like a business. We've always joked that if we ran New Deal Studios the way studios run film production, we'd be out of business in a week!"

MATTHEW GRATZNER

run more like a hardware store. We have to pay our bills, and so we've become very efficient at what we do.

GRAY MARSHALL: Something that has worked for Gray Matter is that we've really tried to choose our projects based on script and not on the effects. And the result is that when people talk about the body of work that Gray Matter has done, they may not be talking about the next Academy Award for visual effects, but they are talking about films they've enjoyed seeing. We've always wanted to work on those kinds of films, rather than effects extravaganzas. We've worked on films we're proud to have been part of. We will always choose a project based on the story, rather than a project that gives us a chance to do a lot of great effects – and that has worked very well for us.

JOHN DYKSTRA: One of the best paradigms for success, of course, is to have a powerful benefactor – like George Lucas. ILM has a lot of talent, and they’ve executed a lot of brilliant ideas; but it is also true that George has had deep enough pockets to keep them afloat during the tough times. He’s also had a built-in resource, because of his relationships in the industry – such as his relationship with Steven Spielberg – and the movies he has made himself. So he was able to keep that facility going. The places that are independents, without that kind of connection, have a tougher time.

JIM MORRIS: But even ILM started out in this business shooting from the hip. Staying in business is something we’ve all had to figure out. There wasn’t any guidebook on how to run a viable effects business.

CINEFEX: ILM kind of wrote the guidebook.

JIM MORRIS: We did. At this point, we’ve been around long enough to make a lot of mistakes, and then learn from those mistakes. We adopted practices from the live-action production arena, and we also made up a bunch of our own. And, over a period of time, we’ve come up with some approaches that have worked.

CINEFEX: I don’t know if they still do, but ILM used to have a mechanism in place in which they would get net points on the films they did effects for. Is that a successful mechanism for making some profit? Or is the whole net profit participation thing so bogus that it’s not worth pursuing?

SCOTT ROSS: Yes to all of the above. When I was at ILM, we walked into every project, and said: ‘There are certain things we need. We need to shoot all the plates. We need to have a certain number of credits. And we need X number of net points.’ And, back then, studios were granting that. The payoff was still rare in coming, because you needed that combination of a huge boxoffice success that cost only \$15 million. You needed a movie like E.T. or Cocoon, where the cost of the movie was so low and the boxoffice so high, they couldn’t hide the profits. But nowadays, the studios aren’t open to anything like that. They want to limit your credits. They want to limit your activity on the DVD. And they don’t want to give you any points. Even if you got them, they wouldn’t be worth anything, because the cost of the films is so high, you’re never going to see net profits.

CINEFEX: We started our state of the art forum by asking how the transition from photochemical to digital had changed the art and science of effects. How has the digital revolution changed the effects business?

RICHARD EDLUND It has changed it completely. I started Boss Film in the photochemical era; and in order to be in that business at that time, we had to build our own tools. To do what I wanted to do back then, I had to set up a company that had an engineering department, a machine shop, a design crew, cameras, stages, matte artists, animators, roto people, modelmakers, makeup people. Boss got up to 400 people at one point. And then digital came along, and I realized I didn't have to be in business in the same way anymore. I didn't need an entire infrastructure devoted to inventing and building things, because I could buy the computer, and I could buy the software. It was all out there. All I needed was a checkbook.

CINEFEX: So, instead of dealing with all the hassles of being a businessman, you decided to close Boss and go back to being an independent effects supervisor.

RICHARD EDLUND Yes. Now I just play with somebody else's toys. I'd just as soon have somebody else hire a personnel department. I don't need that.

CINEFEX: When the digital era started, effects companies had to pay huge amounts of money for supercomputers just to get into the digital game. How did some of you manage to stay afloat, financially, during that shaky transition period?

BILL TAYLOR: Well, what we did at Illusion Arts was get into digital effects without spending a million dollars on a supercomputer that would be obsolete about the time we finally paid it off. Going into debt to buy some of those big iron computers put a lot of good companies under. Instead, we learned – from the very beginning – how to do this stuff on desktop computers that didn't cost a fortune.

CINEFEX: So Illusion Arts never went the Silicon Graphics route?

BILL TAYLOR: No. We had no choice but to swim upstream against the SGIs, because we didn't have the money to buy them. And that is one of the reasons we survived.

CINEFEX: While it made some companies go under, the switch to digital led to a lot of other new companies starting up – especially once the less-expensive desktop systems became available.

TIM McHUGH: Yeah, suddenly everybody had access to CGI – not just the big companies that could afford the supercomputers – and for a fraction of the cost of the early SGI systems, you



"In the early days, a lot of studio people preferred to have something done badly on a high-end system than to have something done well on a desktop system, because they felt they were getting their money's worth that way."

VAN LING

could build a facility. Area 51, and a lot of other places, only came about because of that change in the business.

RICHARD HOLLANDER: The fact that startup costs came down so much was a big change. At Rhythm & Hues, for example, we initially bought a \$50,000 processor that you can get now for \$2,000 – a high-end processor! Visual effects became a commodity, something that was easier to do. It wasn't just for certain select people to do. A lot of people could do it with the software that was out there.

VAN LING: At Banned From the Ranch, we tried to be the poster boys for using desktop systems rather than the high-end systems, even early on. We wanted to be a small company that didn't have to rely on expensive technology to do the work. We wanted to show that you could be lean and mean and fast. So I was always the first one to say: 'And we did this all on Macs! We did this on a desktop!' I thought that proved that it was all about the talent, rather than the technology.

CINEFEX: Some clients didn't want to hear that, though.

VAN LING: No, they didn't. In the early days, a lot of studio people preferred to have something done badly on a high-end system than to have something done well on a desktop system, because they felt that they were getting their money's worth that way. Some boutique companies actually kept SGI systems humming in their front rooms where their clients could see them; but they actually did their work on Macintoshes in the back room!

CINEFEX: So, what happened to SGI? It was so prominent at the beginning – why didn't they keep up with how things were going and come up with their own lower-end systems?

VAN LING: From what we saw and experienced, SGI got really arrogant. They got the idea that not only was their stuff great to use, it was the only stuff any self-respecting artist would use. They were the 800-pound gorilla, and they acted like it. They got to the point where they were saying: 'If you want our equipment, you're going to do whatever we tell you to do.' Unfortunately for them, as they were taking that posture there were vast inroads being made on the desktop side. They had power and brute force, but they got lazy when it came to innovation and efficiency.

HARRISON ELLENSHAW: I remember taking a trip up to Silicon Graphics when they were at their height. They were throwing parties in Hawaii and they were rockin' and rollin' – and I can remember those of us from Disney saying: 'Don't take us for granted. Hollywood is very fickle, and if you don't keep doing good stuff, we'll take the next guy that comes along.' But they never took that seriously. And they went from the top of the heap to off the screen, almost overnight. It all had to do with economy. 'Okay, I can spend \$70,000 on a workstation, or I can spend \$6,000 on one that has half the capacity – so I'll get two of those and that's only \$12,000.' Do the math! But SGI never got that. They said: 'Look, it's an Onyx! We'll paint it purple!' And Hollywood went, 'We don't give a shit.'

CINEFEX: Another benefit of the digital era, in terms of startup costs and continuing overhead, is that you no longer had to have a huge physical plant. You didn't have to have a location with large stages and model shop space.

TIM McHUGH: The name 'Area 51' came about because, in the beginning, for the better part of a year, I didn't have a location! I would hire people and they would literally work out of their bedrooms or garages. I filed all my business paperwork with my home address. Because we didn't have a location, we would take our demo tapes to producers and sit in their offices. They never quite knew where we were, and we kept it that way.

CINEFEX: Some boutique companies out there still operate that way. And then, at the other extreme, you have companies that put a great deal of money into very slick spaces.

TIM McHUGH: I remember going to Siggraph a couple of years ago, and a company that mostly does commercials had people talking about how great it was to work in their building because it had custom furniture and specially-designed artwork. I think they even had custom-threaded toilet paper in the restrooms. Standby sushi chefs and Belgian waffle makers at all times. They were letting everyone know in no uncertain terms that it was a very expensive building just to walk into. And I had to laugh. I said: 'Well, our company's kind of the opposite. You walk in and you'll see some IKEA furniture, which we put together ourselves. The artwork on the wall actually came with the building, because the landlord hung it up there.' We just don't dress ourselves up a lot. We let the work speak for us.

CINEFEX: In running a visual effects company, one of the variables is expansion – how big do you allow yourself to get? What size is the right size?

KEVIN HAUG: I think the most successful businesses tend to be under a hundred people, owner-operated to some extent, and driven by a particular vision. Those companies, especially if they're running off their own money, can go on forever. Illusion Arts is still kicking. Hybride in Montreal has been there forever, the same partners, and they're completely profitable. They have a core of about 75 people, and so the boss can know everybody's name and what everybody is doing today. BUF's another example – 75 to 100 people, the same owner for years. That seems to be what makes it work.

CINEFEX: Those of you who've remained relatively small – ever tempted to expand and become one of the big boys?

CRAIG BARRON: Sure. We turn down a fair amount of work because of our size; and when we do, we always think, 'Should we just expand and take this on?' But that's a very destructive business plan for the long term. We have been in business now for 15 years, and that's quite an achievement when you look at all the other facilities that have come and gone in that period of time.

JAMIE DIXON: We don't want to grow too big, either. We've done it on a temporary basis, and it was pretty hairy and stressful; but we'd never want to do it permanently. We've got a pretty cool little setup here. We've got four partners that are involved with the company; and even after ten years, all four of us are still pretty satisfied. We're all feeling pretty cozy. Nobody's robbed the till and gone off to Las Vegas. So I'm definitely sensitive to breaking that dynamic and trying to get too big. I'm not interested in losing my company.

“Being smaller [means] you can't take on the huge shows. If you did, your entire studio would be flooded with one picture for the better part of a year... If you're stuck on a single picture for a year,

everybody forgets about you. And then, if that picture tanks, nobody wants to know you at all.”

PHIL TIPPETT

PHIL TIPPETT: We’ve flirted with the idea of getting bigger, but we’ve always retracted because of the fear of losing our ability to run the company the way we want to. Being smaller does put you at a disadvantage, though, because many times you can’t take on the huge shows. If you did, your entire studio would be flooded with one picture for the better part of a year. It’s essential that you take on multiple jobs, that you keep your hat in the ring and get yourself known around various studios. If you’re stuck on a single picture for a year, everybody forgets about you. And then, if that picture comes out and tanks, nobody wants to know you at all. The balance in staying a small company that specializes in visual effects is a very tenuous one right now. You are at the whim of so many contingent forces.

CINEFEX: In the past ten years, particularly, we’ve seen an eruption of boutique effects companies, which co-exist with the very large companies such as Imageworks and Digital Domain and ILM. But there is a conspicuous absence of the midsize effects facility now. Many of them have closed their doors. What happened to the midsize company?

MIKE FINK: I think there is a size – around 80 artists – where it is impossible to make money. You will lose money at that size. You can be smaller – 30 artists – and you can be bigger, around 120 artists, but in that middle range, you can’t make it. Because your overhead is way too high for the amount of work you can actually produce. You have to get past that level so you can produce enough shots to stay alive.

KEVIN HAUG: The companies that closed were all just the wrong size, with too big a payroll. And in the long run, it was too much money on the line every month to be able to sustain even three months without full employment. Even if you expand and contract your workforce, that doesn’t work if you’ve got too much overhead.

VAN LING: The midsize companies got too big to do mean and lean work; but at the same time, they weren’t big enough. That’s what happened with Banned From the Ranch. We hadn’t reached critical mass to dive into buying millions of dollars’ worth of equipment and become one of the big players. A lot of the midsize facilities just realized there wasn’t a way to make it worthwhile. We also started running into studio issues, like unionization.

JOHN VAN VLIET: The whole business corporatized. All the studios were bought up by large corporations, and that was followed by what I call the ‘carpetbagger’ time, when all of these MBAs and business types showed up to show us how to make movies. For a while, every time you turned around there was this army of suits telling you how to do everything. All these guys put themselves in positions of power and, basically, they looted the business. So, now, pictures are incredibly overproduced – you’ve got six or seven producers per show – and the costs have gone



“I knew it was over when [the studios] started coming in and telling me what they were going to

through the roof. The movie business has become very top-heavy, and the looting goes on.

CINEFEX: So how, specifically, did that affect midsize companies such as Available Light?

pay for shots, and it was completely unrealistic... I love this business, but I wasn't going to make a charity out of it. So, when it wasn't cost-effective anymore, I closed the door and moved on."

JOHN VAN VLIET

JOHN VAN VLIET: The way it affected us, and other places like us, is that we were asked to do things cheaper and faster than ever before – and, for a while, we did that. But we watched the profit margin get smaller and smaller. The studios just became very predatory in getting stuff done. I knew it was over when they started coming in and telling me what they were going to pay for shots, and it was completely unrealistic. But you either went along with it, or you didn't get the job.

CINEFEX: And the abundance of new boutique companies gave the studios a lot of leverage when it came to that.

JOHN VAN VLIET: Right. Just about that same time, schools started kicking out a bunch of people who all thought they knew how to be animators. Anybody who could rub together a couple of computers was opening up a place. So the studios were able to run around and get people to put in impossibly low numbers to get shows going – and you knew it was never going to work. They'd come in and say: 'Hey, look, Studio X is going to give us this same number of shots for half what you're charging.' And you'd say: 'But they don't know what the hell they're doing! And they're going to fail!' But the studio didn't care because they were just looking at the dollars and cents. So you either had to go to their price, or they'd go to the other place – which, in turn, would either go out of business or turn in very bad work. I love this business, but I wasn't going to make a charity out of it. So, when it just wasn't cost-effective anymore, I closed the door and moved on.

CINEFEX: So, basically, the middle-class facilities were put out of business by the studios and by these little ... I don't even know if you can call them effects facilities.

JOHN VAN VLIET: Effects garages.

VAN LING: Another factor was the competition from video post houses. They were doing a lot of commercial work, and they could make their money doing that or doing music videos. So they were able to come in and bid very competitively on movies, because they were making their bread and butter on commercials.

CINEFEX: We're starting to see more midsize companies appearing, so the business climate must be getting a bit better.

JOHN VAN VLIET: Oh, it's better now, because the studios have fresh in their minds the awful experience of either trying to run their own effects shops or going to these garage shops. It goes through cycles. Right now is a better time to be opening a company than it was a few years ago.

JEFF OKUN: A period where a lot of companies go belly-up is always followed by a period of companies starting up. But what I'm noticing is that the companies that are starting up are going about it in a more responsible manner than the old ones did, with more realistic business plans. It's almost as if the old startup companies were gearing up to be big stars and make big

money; whereas the new startup companies are gearing up to be service companies who are interested in longevity.

CINEFEX: Let's talk about those small startup digital houses. What are your opinions of their work, in general?

MIKE FINK: The work coming out of the small facilities can be excellent. They do have some limitations, however. The small places have a few people doing everything, so there isn't always a good level of management. And you can't always rely on small places to get your work done because they don't have a lot of processors. So even though there are really creative people there, if you have a shot that requires volumetric rendering, or a shot involving HDRI or subsurface scattering – those types of things take a lot of processor cycles. And the small companies just don't have that kind of processing power.

“A period where a lot of companies go belly-up is always followed by a period of companies starting up. But what I'm noticing is that the companies that are starting up are going about it in a more responsible manner...with more realistic business plans.”

JEFF OKUN

RICHARD HOLLANDER: Their ability to do a lot of work can be an issue. But that is changing. Weta started almost from scratch, and they were able to pull off Lord of the Rings! So even the idea of smaller companies not being able to handle a lot of work is suspect.

CINEFEX: Some of the advantages of smaller companies, from what we've heard, is that they can incorporate new software much more quickly than large companies with very complex, established pipelines. They also offer more hands-on interaction, sometimes, than the bigger companies.

GRAY MARSHALL: And that personal touch is very important. I stay very close with the editor and the DP and the director on every project, and they know that they can count on that personal contact. They know we will do what it takes to work with them and achieve what they want to achieve, without becoming a corporate face to them.

CINEFEX: On the other hand, the big companies offer a lot of processing power, as well as whole software development teams dedicated to creating new plug-ins and such. Most often, the boutique companies have to use off-the-shelf tools.

JIM MORRIS: But they do some really good work with those off-the-shelf tools. They make do with it. And what's it all about at the end of the day? It's all about having great images up on the screen. However you do that, whether it's with proprietary software or with a camera and gum and rubber bands, that's what the goal should be. It's not about who has the coolest tools.

GRAY MARSHALL: Even though we don't have a hardcore software development team, our artists are always innovative, always trying to find new ways of doing things and new tools to use.

CINEFEX: Other things you get with big companies are years of experience, a smooth-running machine, a sense of security that they'll deliver.

JEFF OKUN: And their name means something to fans. On Die Hard 2, I said to Joel Silver: 'I don't understand why you hired ILM to do this. These aren't groundbreaking effects.' And Joel said, 'The name "ILM" puts ten to fifteen percent more money in my boxoffice.' He was right, and I don't see that changing. When I see a movie that has the name Digital Domain or Sony Imageworks or ILM, it makes me want to go, because they are always doing something good and interesting. But a movie made by some of the smaller companies? I know they will do good stuff, but there isn't the same level of excitement about it. I think the name value of some of these big companies will not diminish over time.

"Ultimately, the studio's job is to watch their money and make sure you are not wasting it. They're not really there to help you make the movie. They feel they've helped you enough just by giving you the money."

KEVIN HAUG

CINEFEX: One of the things that has changed during the past few years is that there is a lot more studio oversight of effects during production. Part of that oversight comes from studio vice presidents of effects or postproduction. Do you find it helpful that the studios now have these executive-level people? Or is it a hindrance?

SCOTT ROSS: It all depends on the relationship. If you have a good relationship, it's very helpful. If you have people in those positions who actually know what is going on and, even better, have run a facility themselves, then they know that you're not ripping off the studio - which is what the studio always thinks you're doing. They know that, as a matter of fact, you're probably not making any money. Those people can speak with the other studio execs, and that's helpful.

KEVIN HAUG: It makes sense from the studio's perspective to oversee visual effects during production; but it's not necessarily a good trend from my point of view, because do I want to have that much more oversight? Ultimately, the studio's job is to watch their money and make sure you are not wasting it. They're not really there to help you make the movie. They feel they've helped you enough just by giving you the money. Now they want to make sure you're not fleecing them.

JIM MORRIS: I think when the numbers get so big, when the visual effects budget becomes such a big part of the production costs, they have to have a person at the studio who is responsible for managing it. I've had great experiences with the studio execs who oversee this work. The level of sophistication they have and the knowledge they achieve over time of who's out there and who's doing what - I think they're an impressive group of people, and some of them are exceptional in what they do.

CINEFEX: In addition to the studio executive in charge of effects, there is now a production-level visual effects supervisor and/or producer on nearly every big effects show. Why did that become necessary?

MIKE FINK: Because shows have become so complicated, and the effects have become so much a part of the storytelling. There are just too many shots. In X-Men 2, a third of all the shots in the movie were visual effects shots. In the Matrix films, 60 to 70 percent were visual effects

shots. Once you start influencing that many shots in the movie, you have to have an effects supervisor who is there daily with the director, trying to figure out how to do everything. Filmmakers are beginning to see the alliance with visual effects supervisors the same way they see the alliance with directors of photography and production designers. You are representing the director and are helping the director to tell his story. Individual artists in the facilities don't know what the director is going for. They just want to do something cool, whether or not it helps tell the story. The main advantage of a freelance supervisor is that he brings the director's vision more immediately in front of the artists.

CINEFEX: As the production visual effects supervisor or producer, how much say do you have in 'casting' effects facilities for a show?

JOHN VAN VLIET: It depends. There are some studios and some shows where they are like, 'Just do what you think is right.' And there are others where they will tell me who the vendors are going to be. Sometimes, I get my preference on half the vendors, and they get their preference on the other half. So it's all over the map. What is unpleasant is when they hand you somebody that you know is woefully inadequate to do the job; but, for whatever reason, they are being awarded the work. That happens, unfortunately, and I have to respect the studios' wishes because they're my employer. The best thing you can do in that situation is figure out how to make the inadequate vendor have the least negative impact.

JEFF OKUN: More and more, I'm finding that they are telling me who I have to use. There are times when I lose my power to use the little companies I want to go to, because there have been a number of companies in the recent past who have gone out of business - and the studios and producers are worried about being left holding the bag. There have been instances where they wanted me to prove that a little company was fiscally stable, so that they could be assured that the company wouldn't go out of business. But their definition of 'fiscally stable' isn't remotely realistic for some of these smaller companies.

CINEFEX: Assuming you do get to say who gets the work, what criteria do you use in choosing facilities?

BROOKE BRETON: I don't ever pick a facility for the facility. I pick it for the supervisor and for the team. Every supervisor has his own aesthetic. I look at the supervisor's personality, and if that is a good fit with the director. I look at whether they share a common vision for the picture, and if they are able to establish communication. There are considerations as to whether they can meet the financials, how flexible they can be in working with me. You have to see what other projects you're going to be competing against. You don't want to go to a facility that has so much work booked you think that, no matter what, your supervisor is going to have a tough time getting resources.

CINEFEX: How do you balance looking out for the interests of the studio, which is your primary employer, and looking out for the interests of the effects companies? Many of you ran such companies before, and I assume you don't want to put them out of business or deal with them unfairly.

JOHN VAN VLIET: It's tough. Often, the studio attitude is, 'We don't care who we kill to get what we want.' But I try very hard not to be party to that.

KEN RALSTON Not just the studios, the directors, too. I've known of directors who will use a small company because they can destroy it – because a small company can't afford lawyers to protect it. So a director can go in and screw with them all he wants, changing shots and finessing and stuff, and now that small company is losing money. They've spent their allotted time on it, but they can't tell that big-time director 'get lost,' because they don't have the clout to do that. And some directors love that, because they can get what they want, and to hell with that little business. They want their movie done. I don't know how much of that goes on now; but there was a time when that was happening.

CINEFEX: That's pretty cold.

KEN RALSTON Yeah – it's a sweet business, isn't it?

CINEFEX: For those of you running effects facilities, or working within effects facilities, is the addition of a production-side supervisor advantageous to you?

JIM MORRIS: Usually. There are some great people who freelance as production-side visual effects producers and supervisors. Most of them are masters, and they do a great job.

RICHARD HOLLANDER: But it does add another layer to getting the job done. You have the director, and then this other layer of management. Having them on a show certainly serves the purposes of the filmmakers, because they represent the filmmakers' interests. And some of them help us a great deal. Others don't. It depends on the individual.

CINEFEX: Surely, one reason the production visual effects supervisor position has become necessary is because of the multi-vendor approach to visual effects production, which is now far more common than taking a show to one facility. Why has that come about?

MIKE FINK: Part of it is that shows started to grow beyond what a single facility could do. Even a place as big as ILM can't always do an entire show, because they've got other projects going on at the same time. Also, since studios are budgeting and scheduling movies unrealistically from the get-go, you can't plan appropriately – and that means you have to have multiple vendors, because you have to find a new facility that can take on additional shots later in

The Most Expensive Words in Production.



"Since studios are budgeting and scheduling movies unrealistically from the get-go, you can't plan appropriately – and that means you have to have multiple vendors, because you have to find a new facility that can take on additional shots later in postproduction."

MIKE FINK

postproduction. You need a new facility that is fresh, not already exhausted and tapped out, that can dive in and finish a sequence.

KEVIN HAUG: One of the reasons that we have so many multiple-company shows is that you start out with a director telling you 25 shots, which really means 75 to 300. So there's one budget, and then there's another budget, and another. As a single company, you can't really organize yourself around that very well. You can't be everywhere doing everything that the production needs. So you start to rely upon specialists who can do certain kinds of things for you. That's much more akin to the way a movie works, anyway. The movie industry is all about casting. Who's the best at X? You find out who they are and hire them to do it.

BROOKE BRETON: And there are budget considerations, of course. Maybe you can only afford X number of shots at a big facility, and the rest have to go elsewhere. I think it's a very exciting approach. I've discovered a lot of new, terrific companies in the process of splitting up the work.

JEFF OKUN: It's energizing, because you're giving the guys who have fled the big companies a chance to prove themselves, and they always rise to the challenge. You get more for your money, and the stuff looks really good. There is also, in addition to the financial aspect of it, a synergetic effect to using a lot of companies. It just raises the level of everything.

CINEFEX: In wrangling all of these companies, are there problems in exchanging information, keeping everyone on the same page?

BROOKE BRETON: Well, fortunately, the tools for communication have become very quick and immediate. So the communication between companies – even at long distances – has tightened up a great deal. And the more people do previz and work out their problems beforehand and articulate that to one another, the more we're getting companies that can work well together.

CINEFEX: Given these advantages, are there any downsides to splitting up a show?

VOLKER ENGEL: I think so. Personally, I don't like the multiple-company way of doing things. But, usually, you can't avoid working with multiple companies, not only because shots get added in the last five weeks, but also because there are companies that are good for specific things, and other companies that are not. It's going to continue to be split up this way. If anything, it's going to become more like that.

KEN RALSTON I hope not. I hate sending stuff out. It breaks up my concentration, and that's just not the way I like to work. At least do the majority of the work, and the most difficult work under one roof, and then send the easier stuff out. I'm okay with that. But it's not a way that comes natural to me. Some people love it. I think it just depends on how you like to work.

SCOTT ROSS: I think there are definitely downsides to splitting up a show, especially from the producer's standpoint. You have a whole group of people managing the different visual effects studios, and you have each visual effects studio managing its shots. So you've got layer upon layer of management, and, as a result, the producer loses some level of control. You actually have more power and even more flexibility in a big house if you park a big show there. And it's more economical. Give us 150 shots, the price is going to be higher than if you give us 250 shots, because we're able to amortize the cost of technology, infrastructure, personnel. Over 250 shots, the per shot cost comes down.

JIM MORRIS: There is also a consistency when you do a show at one facility. We certainly feel we do our best work that way. When you divide a show among 20 Mom-and-Pops, at some point, it just breaks down in terms of quality and consistency. Somebody is not going to quite pull it off.

CINEFEX: But even ILM is now most often listed with a lot of other companies at the end credits.

JIM MORRIS: That's because there are times when it doesn't make sense for us to do wire removal and that kind of work; so if the production can get it done cheaper at Mom-and-Pop Wire Removal, why not? We probably should be focusing on doing great character work, the more elaborate ends of visual effects work, the stuff that requires a little more nuance, style and taste. That doesn't mean we wouldn't love to do the whole show; and when we can, and we can be competitive on those other things, we do.

CINEFEX: Do you foresee a situation in which ILM or the other big companies would almost act as producers, taking on the responsibility of a show, but parceling out bits and pieces to vendors as a way of keeping down costs?

JIM MORRIS: Recently, I've had clients suggest exactly that. They've said: 'Look, here's how much money we have. We expect the bulk of it to go to ILM; but if you can make this work by breaking it up and sending pieces of the work elsewhere, and the quality is good, we don't care.' That blew my mind. I figured nobody would buy that from us, ever. So I was just like: 'What? Okay!' It makes sense. They're getting the comfort of having us take the responsibility, but they're giving us some flexibility.

JEFF OKUN: I firmly believe that all the bigger companies will mutate into brokers in the future. The big facilities of the future won't even be facilities. They will be people with Macs or PCs at home, a loose affiliation of people that you call a company. And the only aspect of it that will be a company will be that somebody will be contractually and fiscally responsible. But the people under contract won't be part of a physical company.

HOYT YEATMAN: You'll have a freelance visual effects supervisor who will have his group around him, and they'll migrate from production to production, just like a DP or a production designer does. They will be transients.

CINEFEX: With so many vendors working together on a single show, how do you maintain a uniform aesthetic in the shots?

BROOKE BRETON: That's a whole other issue. Clearly, the only way that happens is if you have a lead team who establishes the aesthetic, then feeds the other vendors and makes sure there is a common, universal language that we're all using.

CINEFEX: To do that, it seems you'd need more standardization and more compatibility between companies in terms of software and hardware.



"I firmly believe that all the bigger companies will mutate into brokers in the future. The big facilities

JIM MORRIS: I think the industry is already benefiting from increased compatibility. It allows for shots and for people to go from facility to facility. It allows your workforce to be a little bit more homogenous in a way that's good. If everybody is conversant on a particular software on a particular platform, it greatly reduces the learning curve in your company.

of the future won't even be facilities. They will be people with Macs or PCs at home, a loose affiliation of people that you call a company."

JEFF OKUN

PHIL TIPPETT: Standardization allows you to exchange information, which can be a problem, depending on what companies you're working with. We never have a problem doing crossover work with ILM, for example, because everybody speaks the same language, and we know what the formats are. But working with ESC, it was like, 'Oh my God, we're not even speaking the same language!'

CINEFEX: It used to be that effects companies took great pride in claiming 'We have proprietary this and proprietary that.' Now, it seems as if it's almost counterproductive to have too many proprietary tools, because of this 'common language' issue.

JAMIE DIXON: When I was at PDI, it was very difficult to do business because we were using all our own tools, and there had to be a huge investment in training people to be able to use those tools. It's changed a lot in the ten years we've been doing business at Hammerhead. On *Chronicles of Riddick*, we hired 40, 45 people who could literally come in off the street and be productive that day, because they were using standard tools that they had learned elsewhere, either in school or at other companies. It has made a huge difference. Even if the tools aren't necessarily the perfect thing for the job, it's worth a lot to be able to bring in somebody who knows what they're doing right away.

"More and more, we're looking to form collaborations with other companies that have different specialties... The producer gets the very best assembly of companies for his project, and we get to work on larger visual effects pictures that might not have been interested in us before."

CRAIG BARRON

NED GORMAN: There's no question that we're moving toward more standardization. But I don't know how quickly the specialization of writing proprietary plug-ins and such will go away. For one thing, you can't always get those things on demand from vendors. The XSI and Maya people have been great about giving us as much time as they can; but we're just one of God knows how many phones ringing on their desks. So if we say we need a plug-in that does this, and we need it now, they may be able to help us, and they may not. And if not, we have to bootstrap it ourselves and rely on our own devices. So there's going to be bedrock packages we're all using, but everyone is going to figure out their own way to use it. We may all buy the same Mustang, but how we soup it up is really the trick, isn't it?

CINEFEX: A positive outcome of the multi-vendor approach is that it has created unofficial alliances between companies that often wind up working together on projects. ILM sometimes joins forces with Tippett Studio, for example. The big companies farm out work to smaller companies they know, through experience, that they can rely on.

GRAY MARSHALL: Right. Rather than being their competitors, we're their allies. We have worked with several of the bigger companies, at their request, because they know that we bring quality to the work. And in many cases, the big companies have said: 'You know, this isn't really appropriate for us. Why don't you go and talk to Gray Matter?' So it is a community, not a competition. I wouldn't want to have to compete against the big boys at their level; but at our size, we are either an alternative that they are happy to offer their clients, or we are a reliable adjunct to them.

CRAIG BARRON: We've addressed it the same way. More and more, we're looking to form collaborations with other companies that have different specialties, like Phil Tippett's company. I see them as some of the best CG animators on the planet; and I feel we're among the best at what we do. So how about putting those two companies together and going after a project where that's a custom fit? The producer gets the very best assembly of companies for his project, and we get to work on larger visual effects pictures that might not have been interested in us before. It's a good solution.

CINEFEX: Let's talk a bit about visual effects budgets, which are spiraling. You hear some mind-boggling numbers thrown around – \$35, \$50, \$60 million, and higher. Is there a way to contain these budgets? Do they need to be contained?

NED GORMAN: If we're going to survive, they have to be. I think it is incumbent on visual effects producers and supervisors to figure out a way to fulfill the director's vision, but without breaking the bank, because there will come a point where it will come crashing down under its own weight. I'm no Alan Greenspan, but I know the economy will bear only so much.

CINEFEX: One of the constants in visual effects and production budgets is that the initial numbers are unrealistic. Films rarely come in for the original budget that the studio signed off on. Why is that?

MIKE FINK: It all has to do with decisions that are made to get the movie greenlit. You break down the script, and initially you have 800 effects shots, which are going to cost \$35 million. And the studio says that you have to get that visual effects budget down to \$25 million. 'How many shots can you do for that, in the time you have?' So you say, '500 shots,' and you get it down to 500 shots, just to get the movie greenlit. But the number of shots, and the budget for those shots, have nothing to do with reality. In reality, that movie still needs 800 shots, and still needs \$35 million! And everybody enters into the deal knowing that.

CINEFEX: The studios know they've greenlit the movie for less money than it's really going to take.

MIKE FINK: – but they also feel they've got it down to a number for which the movie can be made. They just can't allow themselves to start out where they think they're going to end up, because then things can really get out of control. By putting clamps on in the beginning, when things go over-budget, they are at least going over a smaller budget than they could have started with.

CINEFEX: The irony of these outrageous production and visual effects budget numbers is that, as high as they are, they don't reflect higher profits for the effects companies. The studios

continue to cut your budgets, cut your profit margins. Visual effects seems to be the first place they look to cut production costs.

SCOTT ROSS: It is. Studios look at their top-sheet budget, and the biggest number is what they're paying the actors – but they can't do anything about that, because if they did, Michael Ovitz would kill them and they'd never make a movie again. So, okay, let's go after the next biggest budget number, which is effects. They think that we're screwing them and making all this money anyway, so why not go after the effects companies? And everybody in the effects industry drops their shorts. 'Okay, anything you want.'

NED GORMAN: It's just the nature of competition. If we know we're competing against Sony or Digital Domain on a bid, we cut it as tight as we can. And every house has bought jobs in the last couple of years, just to keep their resources going. That's no secret – and it's no secret to the studios, either.

CINEFEX: It's a sweet deal for them.

NED GORMAN: It is – but you know what? It's that way in every industry in this country. You've got to be mean and lean to stick around.

MIKE FINK: The problem is that the studios have a set budget, too. Take Warner Brothers. They are given so many billions of dollars a year by Time Warner, their parent company, and they are told: 'Here's your budget. Make however many movies you want to make; but this is all the money you're going to get.' When Warner Brothers budgets their movies, those budgets have to fit within that limit. So, from their point of view, when things start to get too expensive, they get scared. They're not looking at movie production from the perspective of telling stories. They are looking at it in terms of money.

CINEFEX: One of the things we hear from companies is that the studios beat them up in brutal bidding wars. Everybody has to undercut their bids to the point where they can't even turn a profit, especially now that they're bidding against low-overhead operations working out of spare bedrooms.

CHRIS GODFREY: That's one of the biggest problems we've got right now. The knowledge base is spreading wider, and for \$20,000 you can go out and get yourself a good little machine and a computer software program, and you can sit in your bedroom and composite shots and make a living out of it. And we're quoting against that man down the road. People have said, 'We intend to quote with these startup houses.' And you say, 'Well, where's the guarantee in that?' And they say, 'There is no guarantee – but if it doesn't work, we've got enough time to rip it off them and give it to another house.' That's happened a number of times recently.

PHIL TIPPETT: Now that everybody and his brother is doing this stuff, the bidding process is ex-tremely volatile. You find in some seasons that every single bid you send out is a check bid for somebody else, and you've just wasted tons of time doing a lot of work so a producer can lower somebody else's cost.

JOHN VAN VLIET: When I had my company, the bidding process was just insane. People would come in, and not only would they ask you for a bid, they would want your entire method for doing the shot. Their explanation was, 'You have to show us how you would do this so we can

decide if you know what you're talking about.' And, basically, once you had done all the engineering on their stuff, they'd pick it up and take it to the guy they wanted to give it to in the first place. I realized that I was essentially working for free as a research department for a lot of projects, and explaining to them how to do things. And then they'd happily go off and do them. That got real old.

"The bidding process was just insane. People would come in, and not only would they ask you for a bid, they would want your entire method for doing the shot... And, basically, once you had done all the engineering on their stuff, they'd pick it up and take it to the guy they wanted to give it to in the first place."

JOHN VAN VLIET

NATHAN McGUINNESS: If someone comes to me and tries to get the dollar down, I just walk away from it. A lot of companies will do it, but I can't afford to take that kind of hit. So I don't fall into that trap of clients playing me off another company. When we're bidding against other companies, sometimes we're higher, sometimes we're in the middle, and sometimes we're lower – but wherever we are, that's our God-honest bid. I make sure it is a viable, profitable, bid. I don't ever do a job unless it is financially viable.

MATTHEW GRATZNER: When we bid a job – even if we don't have a chance in hell of getting it, and we think it is just a check bid – we bid it very realistically. We never throw out ballpark bids. We come up with what it is going to take, down to the letter. Then, if we get hired, we apply that exact thinking to the job. We never just throw out some off-the-cuff number to a client. And because of that, we never have to go back for more money. That's been a very successful strategy.

JIM MORRIS: At ILM, because we've worked on so many films, we have very elaborate histories in terms of what it took to get various effects done, and that helps our bidding process. With every show we complete, we put a bible together, which becomes a reference for any subsequent work that we do. 'To do a shot like that has, on average over the last couple of years, taken X amount of man-hours.' Having all of that information is very helpful in determining what it is going to take to do the work on a show.

CINEFEX: Younger companies don't have the benefit of that history.

JIM MORRIS: They don't. So they come in – I'm sure with the best of intentions – and they say, 'Well, we can get the work done, and this is what it will take to do it.' And sometimes they dramatically underestimate what it is going to take to pull off the show. That's where shows get into trouble and we start getting the 911 calls.

MIKE FINK: Another problem with the bidding process is that a visual effects facility will bid shots, but the studio won't okay the work until the last minute – which makes the original bid invalid, because now the facility doesn't have the same amount of time in which to do the work. The initial bid was to do X number of shots in X amount of time, not in half or one-third that amount of time. So now the facility is having to deliver shots overnight. And that is really hard. Making pictures out of ones and zeroes is incredibly difficult; but we keep pulling off these incredible stunts, finishing shots overnight that should have taken six weeks. So the studio

thinks we can always do that, and that's why they don't worry about burning up time during the approval process.

CINEFEX: Is there any way around that?

MIKE FINK: On Constantine, I went to the studio, and said: 'If you give us approval today, it will cost X. If you give us approval two weeks from now, it will cost X plus 2' – and so on. That did speed up the approval process somewhat.

BROOKE BRETON: I may be one of those rare creatures who actually enjoys the bidding process. Some parts of it I don't like, of course. It's hard to call a company and tell them that they don't have the work, especially when they've put their heart into doing a bid. On the other hand, it can be a very creative process, looking for different approaches to a problem, and the right people to execute those approaches. It's not always driven by finding the lowest number. It's about finding the right fit, too.



"If all the people asking for the bid are looking for is the cheapest price, there is always somebody who will take you down. No matter who you are, there will always be somebody with less overhead, with less expensive mouths to feed, who will underbid you."

GRAY MARSHALL

GRAY MARSHALL: Look, here's the thing about bidding. Everybody wants the lowest price. And if all the people asking for the bid are looking for is the cheapest price, there is always somebody who will take you down. No matter who you are, there will always be somebody with less overhead, with less expensive mouths to feed, who will underbid you.

CINEFEX: But how do those chronic 'underbidders' continue to survive?

GRAY MARSHALL: They don't. The lesson of recent years is that the companies notorious for taking it to the mat and going for the lowest price are now gone. They are gone, either because they bid so low they just couldn't make enough money at it, or because their reputations caught up with them – that they could do it cheap, but they couldn't do it well. One way or the other, those houses are gone.

CINEFEX: In our last discussion, we talked about the aesthetic consequences of movies having an overabundance of effects. Coming at it from a business perspective, isn't it a big waste of dollars and resources to fill a film with 1,000, 2,000 effects shots? Isn't there something to be said for smaller budgets and fewer shots?

VOLKER ENGEL: Absolutely. Producers and studio executives need to have a heart-to-heart with the director and tell him to hold back. 'You don't have to do it this way. It's \$2 million wasted.' A lot of times, you see these poor artists slaving away for months, and it is absolutely unnecessary to tell the story that way. You know, sometimes dialogue can go on in front of a building instead of in front of 12 battling ships in the background. Nobody is going to appreciate those 12 battling ships; but you had a team of 45 people working for three months to

make that happen. I am amazed by the lack of knowledge of moviemaking and effects when it comes to some studio executives and producers.

CINEFEX: Speaking of that, let's address the phenomenon of studios getting into the visual effects business. The studios have a pretty spotty history of opening in-house facilities, then closing them down within a couple of years. Disney has buried three visual effects companies in the last ten years. Warner Brothers has buried two. Why can't the studios make a go of their in-house effects facilities?

MIKE FINK: Well, they thought they needed to own them in the first place because visual effects were so expensive. They thought that by owning their own facility, they would get visual effects 'at cost.' But what they didn't realize - and what they found out later on - was that they already had been getting visual effects at cost! They couldn't get them any cheaper by owning their own facilities, because the outside facilities hadn't been making money on this to begin with. On top of that, by owning their own facilities, the studios were actually paying for things that they had been getting for free from outside vendors. They hadn't been paying for overhead, for software development, because no facility really prices their product to cover those things. If they did, they'd price themselves out of business!

JIM MORRIS: Studios get into it because maybe there is a filmmaker who wants it - like the Wachowskis. Or, again, they think it will save them money. But then they do it, and soon they realize - 'Oh my God, not only are we not making any money, we're not even saving any money...' So they close their facility down.

CINEFEX: But then, a few years later, they try it again!

RICHARD HOLLANDER: It can only be explained by memory loss. A studio does the analysis, they find out that they are spending this much money, and in their view, they are just making ILM rich or supporting George Lucas' films. So they say, 'You know, if we're going to pay that much to them, let's just go build it ourselves.' So they get together and spend the money, and they open up the thing and they start looking at the bottom line the first year! And in visual effects, you can't look at the bottom line in your first year. So they start to get cold feet, and they decide to pull out. But then those people move off to another studio, and the memory of that bad experience goes away. And there is nobody left who was there when the bad experience happened. So the next group of entrepreneurs at the studio come in, and say, 'Look at all this money we're spending on visual effects!' And they start all over again.



"The film business is now run by financial people who are salivating over the idea of moving the whole process to China, where it's cheaper to have a human being hold a black piece of cardboard than it is to rent a C-stand."

TIM McHUGH

PHIL TIPPETT: But if anybody on the business side of the studios looked at the profit margins of the visual effects racket, they would never do it. Their stockholders wouldn't even want to know about it! It seems the venture is just motivated by a great deal of hope.

TIM SARNOFF: I think it has to do with the economics of the business itself, rather than the efforts of any individual studio. For example, there is a perception that Warners tried to create these companies and then failed. I don't believe that to be true. Warners created these companies and created great movies, which is the ultimate goal. So if you create a company, create great movies, and then you close the company, there's nothing wrong with that. It's not a failure. It's just a business decision. When Warners closed Warner Digital, it was strictly a decision on their part to maintain cash flow toward making films, rather than maintaining cash flow toward keeping a facility open.

CINEFEX: Harrison, you were on the inside and were able to witness what happened with Buena Vista Visual Effects and Disney. Why didn't that work, ultimately?

HARRISON ELLENSHAW: I think the BVVE experience is typical of all the other ones. Studios want to control costs, and they also want to hire and give control over to directors who they think will make successful films – but those two things cannot exist together. Studios are trying to control costs, working with directors who have no motivation at all to control costs. With the movie-making mentality that exists today, every director that gets a chance to spend the studio's money is looking to hit it out of the park. A single, double, triple doesn't do it, because there's a line outside your door of hot, young music video guys, all with English accents, ready to take your place. So that director is not going to say, 'You know, I'd really like to see Batman jump up to the 15th floor, but if it costs too much, just have him jump up to the first floor.' Instead, it's: 'Give me the shot that I've never seen before, and I don't care how much it costs. That's your problem.' Studio executives just don't understand the process – never have, probably never will.

CINEFEX: With Imageworks, Sony has made a success of the in-house effects company, where others have failed. How do you account for that, Tim?

TIM SARNOFF: The advantage we had at Sony was that they were willing to weather our learning curve. This studio wanted to have digital characters, and there was a need for an internal business to create those digital characters. So we had a very clear mandate from the beginning to make this business work.

CINEFEX: There's a perception in the industry that Imageworks is not profitable, and that the only reason you are able to press on is that Sony has made a long-term commitment to the company.

TIM SARNOFF: When I got into the company in 1997, it was not profitable. It was losing a lot of money, in fact; and so were a lot of businesses, because that was not a banner year for visual effects. But we have been profitable over the last five years; and it is likely that we will be profitable for the foreseeable future. We're not creating margins that I'm going to crow about, and I'm not going to say we're the most profitable facility in the world – we probably are not – but that's because there's a lot of money going onto the screen. People don't understand how

we can underbid smaller facilities, and that's probably why there is a perception that we're being subsidized. But we're not being subsidized, we're just applying efficiencies. We may not need to create a giant profit on a character project if we know that the technology is going to be well utilized on another character project. And we're not necessarily worried about the cash flow scenario, since we are given a leeway in how we apply the cash flow. That said, our cash flow seems to be terrific, too. This has been a great few years for this division.

CINEFEX: Do you have a great advantage – like Lucasfilm and ILM – in that you have built-in projects coming your way from Sony?

TIM SARNOFF: Well, for one thing, 60 percent of our work comes from other studios. Secondly, we at Imageworks aren't given projects by Sony. We compete for them like everyone else. We have an advantage because we happen to know what they're going to be; and so we know what we need to do early on. But in no way are we told, 'This movie has to be in your company.' In no way are the producers and directors told, 'You must go to Imageworks.' The people who come here do so because they want to be here, because of the relationships they have with the people at this company, because of the talent. Any studio that thinks people are going to come because that studio's name is on the door is fooling itself about the value of that particular name.

CINEFEX: Let's talk about the globalization of the effects industry. Canada, England, Australia, New Zealand, France have all emerged as significant players in the visual effects field. For those of you based in America – which is still the majority of you – does this development seem like a healthy one, or does it fill you with dread?

CRAIG BARRON: I might look at it more as a good thing if our country subsidized the visual effects industry; but it clearly doesn't, while other countries clearly do. Being on the losing side of that doesn't feel good. The 'Fairness Doctrine' in me wants to see a level playing field, so that we're really just concentrating on people's abilities and achievements, rather than the economic benefits of having a deal subsidized by a different country.

TIM McHUGH: Canada has instituted some very strong subsidies, for example. As they tell the story, that has created jobs in Canada. But the reality is that it has just moved jobs across the border. Years ago, you could bring many more Americans across. But, apparently, what we were used for was to train the Canadian crews. Each year, they have allowed fewer and fewer Americans across the border, and now it's become very difficult to work up in Canada. It's an ongoing, specific pattern – and the result is that the work in this town is drying up.

HOYT YEATMAN: When we went over to Australia to make Kangaroo Jack, it was an all-Australian crew, except for us and the director. That was it. And it will get to the point where we probably wouldn't get to go, either. It is a changing market.

PHIL TIPPETT: A few years ago, I saw it as the garment industry and the auto industry all over again. 'Uh-oh, this is it. We're on the slippery slope, and there are no handholds.' We lost a lot of work overseas. And it is hard, not just business-wise but emotionally, because you really do feel that you're being forsaken. You don't have a voice in the government, and your government is not doing anything to help your industry and is, in fact, giving more incentives for your friends to take their work overseas. It's emotionally destabilizing, because you feel completely

powerless. Recently, things have started to improve, though. Now that the dollar is so low, things are looking up a bit.

ALEC GILLIS: What we've got to do, I think, is find new and creative ways to get the job done efficiently so that the next job doesn't go out of the country. We still believe that the best people are here in Hollywood – and that's not just a nationalistic statement, because we've got people from all over the world here. We have Japanese artists, British artists, European artists all working here, because for years this was the Mecca of opportunity. Now there are opportunities popping up all over the world, which is great for people. But I still think the greatest condensation of top-quality artists is here in L.A.

TOM WOODRUFF: Hollywood is still the filmmaking capital of the world, and we want it to stay that way. We want to attract talent from all over the world, partly so we can count on those people being here when we need them. This is still basically a freelance business; so the more opportunities there are here, the more shops still open in Los Angeles, the better it is in the long run for the people that work here.

NATHAN McGUINNESS: In my opinion, there's got to be a center where all the best collaborate, where you can walk down the street, and there's the best person working down there, as well. Hollywood is still the place where the best come. Hollywood will either make you or break you. It's a very honorable and hard thing to get to Hollywood and be successful – and that's still true, even as things happen all over the world.

CINEFEX: In addition to the financial benefits, is there a certain cachet, you think, that filmmakers consider when they choose to use a European effects company?

STÉPHANE CERETTI: Well, we always talk about the 'French touch' – but I'm not sure that really exists! (laughs) There might be a 'BUF touch,' because we have a certain way of doing things. It's very different working with a French company than an American company. Not better. Just different.

CINEFEX: In our last forum, you mentioned that one of the differences between BUF and most American effects houses is that a single artist tends to take ownership of a shot from beginning to end. Are there other business structure differences, as well?

STÉPHANE CERETTI: Yes. In France, 'company' means 'companion' or 'fellowship.' So what we try to do is have an old guy always working with a new guy, so that they can learn from each other. The new guys learn the tools faster because they are being helped by the old guys; and the old guys, perhaps they see a new way of doing things because of the freshness of the younger guys.

CINEFEX: Is the business climate different in Europe than it is in the United States?

STÉPHANE CERETTI: At BUF, at least, we are less touched by the suddenness of things that happen in business because we don't just work with Hollywood movies, we also work with movies being made in France and the rest of Europe. And we also do commercials. So there is a very good mix of things, and we don't just rely on what we are doing in the United States to keep us going.

CINEFEX: BUF also uses a lot of proprietary software. How does that work when you get involved in a big Hollywood movie and you have to collaborate with American companies that are using different platforms and software?

STÉPHANE CERETTI: Often, we don't have to share data or images with other companies. But when we do, we have translating software that helps us go from their software into our own software. So, even though we don't use the same tools, we can integrate the data, no problem.

CINEFEX: Engaging a European or Australian effects facility when a movie is being made in Europe or Australia is one thing. Is it less appealing to reach out to such companies when the production is still based in the United States? Or when much of the effects work is being done by a U.S. company that then has to collaborate with that overseas facility?

TIM SARNOFF: I think it underestimates the relationship that's needed between the director and the visual effects facility. This is a collaborative, iterative business. If the collaboration is hampered in any way, it will negatively affect the end result. If you don't speak the language, that gets in the way of the collaboration. If you have to communicate when others are sleeping, and they have to communicate when you are sleeping, that gets in the way of the collaboration. If the only time you actually see the person is by videophone, that affects the collaboration. People communicate physically, as well as verbally. And to pick up on all of that physical communication, you need to have them in the room with you.

CINEFEX: It does seem as if it would be a disadvantage to deal with a company far away, with people you would never sit down with in the same room.

CHRIS GODFREY: To deal with that, we've written tool sets that allow us to do a review from a laptop across a normal fire line. We've got to that stage where we can bring postproduction directly to you. Also, Animal Logic now has an office in Los Angeles, purely as a meeting-house type of thing. But we'll probably end up taking equipment into that so that we have a real branch there.

BROOKE BRETON: When I was working on Sky Captain, I never went to Rising Sun, never went to Hybride – just because they were too far. But with the new communication tools, I found that the long-distance companies were really able to stand up well on their own.

CINEFEX: 'Globalization' doesn't only refer to the emergence of visual effects facilities in the Western world. It also encompasses the idea of outsourcing things like wire removal and roto – the pedestrian stuff – to places like India and China and Korea, where a guy is paid 50 cents an hour to work on a machine. There's a lot of talk of that recently.

TIM McHUGH: That's because the film business is now run by financial people who are salivating over the idea of moving the whole process to China, where it's cheaper to have a human being hold a black piece of cardboard than it is to rent a C-stand. To the people who move capital from one place to another, that is nirvana.

JIM MORRIS: I suspect that type of outsourcing is inevitable. It may work well or it may not, but people are going to try it. Some companies already are trying it. But, you know, there's all kinds of outsourcing that has been going on in the system for quite some time. There was a time when

every facility did its own input and scanning and output and film recording. But now a lot of that is done by companies that specialize in it. It makes sense.

VAN LING: I'm not sure it's going to happen. There are a number of factors working against going offshore, one of which is security. A lot of studios are not comfortable with allowing major motion picture assets to go out of the country, where they have less supervision and more chance of things ending up on Ain't It Cool News. That's one of the reasons why over-the-Internet render farms haven't taken off. The security issues are just too great.

CRAIG BARRON: One of the problems in sending out that kind of entry-level work is that, traditionally, those types of positions – rotoscoping and matchmoving – have provided training.

CINEFEX: It's the apprenticeship-level work, the equivalent of the mailroom in a corporate environment.

CRAIG BARRON: Yes. It's how we identify the people who have the potential to go on and do other things. That's how we develop our staff. We want those opportunities to check people out and let them grow.

BROOKE BRETON: When kids are just out of college, those jobs are the opportunity for them to get their feet wet, to work in the entertainment business environment. So the opportunity to do those jobs is really important. I hope that can still be economically viable, because there's a lot to be gained for kids.

CINEFEX: It doesn't seem as if that's economically viable, though – not at the prices at which the work can be done elsewhere. Isn't it inevitable that those kinds of entry-level tasks are going to be sent offshore?

TIM SARNOFF: Not just entry-level – non-entry-level work, as well. When you say, 'Oh, we'll just send the entry-level work overseas,' you're underestimating the talent that exists overseas. Some of that talent, if you underestimate them, will eat your lunch later on. They are really good overseas. There are a lot of unbelievably talented people. And if all you're giving them is wire removal, they're not going to be working with you for very long.

BILL TAYLOR: The people in India are gearing up to do animation, for example, and the skill level is getting there fast. We've seen some wonderful stuff from India that was sort of aesthetically loopy by Western standards, but it was wonderfully imaginative and very well executed. There are smart people everywhere; and if they're trained, they'll be dynamos.

HOYT YEATMAN: When we were doing some consulting work over in Korea, we got the Korean film board to take us around; and we saw some very intelligent people who have the exact same machines that we do, the exact same software that we do. The only difference is that they haven't had the opportunity yet to get a lot of experience.

CINEFEX: Up to now, the cream of the crop from other countries have come here. Effects shops have had a diversity of surnames and accents for a long time. But, at some point, the cream of the crop will stay home and start their own companies in their own countries. And that company in India or Latin America where they can get technologically trained people for next to nothing is going to be a very appealing option for producers and studios.

TIM SARNOFF: Yes, but just wait until you hear the cries when they find out that there are writers in India, too, and that there might be studio heads in India who will work for 20 cents on the dollar! Here's the deal – we are playing on a world stage, and we have to recognize that all the work isn't going to be in our backyard forever. The issue for me isn't that 20 cents on the dollar, because that's a short-term issue. That will last only for as long as these people feel that they're properly paid at 20 cents on the dollar. The moment they don't feel that way, it will become 100 cents on the dollar. Talent will always demand whatever the market will bear, no matter where they live. The issue, frankly, for us, is to make sure that people still think of us as the best place to go, even if we're not necessarily the cheapest place to go. If we were only going to be the cheapest place to go, we would move this company right now to an atoll somewhere in the Pacific. That's not going to be the end game. The end game is still going to be about the talent.

Angels and Demons

ARTICLE BY JOE FORDHAM

One of the most thrilling aerial battles in cinema history was filmed in the skies over California in 1928, during Howard Hughes' second year of shooting his World War I action epic, *Hell's Angels*. The sequence featured 87 vintage airplanes flown by a team of 137 pilots, many of them veterans of The Great War. Hughes famously took to the air himself to capture Daredevil air-to-air action, which tragically claimed the lives of three of his flyers.

Hughes realized another showstopper scene in the film, simulating a bomb run on a German ammunitions dump, by using live, military-scale ordnance to obliterate immense large-scale miniatures set in the California desert. For an eerie sequence over foggy nighttime London, legend has it the production crashed a full-scale zeppelin to re-create a real event that saved Paris from air attack during the war. Creating haunting imagery in an otherwise unremarkable film, the visual effects are still breathtaking by modern cinematic standards, serving as testament to Hughes' vision and his passion for aviation.

image

Hughes' obsessions became the subject of director Martin Scorsese's biographical film, *The Aviator*, released by Miramax Pictures, starring Leonardo DiCaprio as the 20th-century Icarus. Screenwriter John Logan avoided the well-trodden turf of Hughes' physical degeneration in his later years and instead focused on Hughes' airplanes as touchstones along the path of the maverick industrialist's extraordinary career. Beginning with the production of *Hell's Angels*, the film charts Hughes' first forays into filmmaking, then delves into Hughes' love affairs with Hollywood, his development of experimental aircraft, his establishment of Trans World Airlines – challenging Pan American's monopoly of commercial aviation – and the construction of the giant wood-framed troop transporter, the HK-1 Hercules.

To re-create the movie's period aircraft, many of which were now museum pieces, Scorsese and his long-time collaborator, production designer Dante Ferretti, enlisted the services of aerial coordinator Craig Hosking and visual effects supervisor and second unit director Rob Legato. Legato first pitched his take on the assignment to Scorsese by assembling a catalogue of imagery from documentary research to illustrate possible effects techniques. "My instinct was to do as much in-camera as possible," observed Legato. "Working with someone like Marty, who is such a film historian, I thought it would be great to try to re-create film history and be faithful to the way they could have photographed effects back then."

In-camera effects techniques included the use of forced-perspective miniatures, which Legato initially tested in a Pasadena park using a stock 1/48-scale amphibious aircraft. By elevating the

miniature on a ladder in the foreground, the aircraft appeared to be sitting on the distant grass in full scale. "I painted out the ladder in Photoshop," related Legato, "then I painted in the shadows and composited a tree in front of the plane using very simple rotoscoping. It was an example of how we could use digital tools to great effect to enhance a classic hanging miniature effect. When the angle was correct, the sunlight was correct and, with one little CG foreground gag, we got a lot of production value for very little money."

Hanging miniatures allowed Legato to stage miniature shots rapidly and repeatedly, panning and tilting from a fixed nodal point. Legato experimented with motion control for more complex camera mobility. "It was a technique that I set up for the first Harry Potter film and they used a lot in *The Lord of the Rings*," said Legato. "We had a motion control camera linked to a moving scale platform; so as the camera moved, the foreground object moved in relation to it. I did a test move around a miniature plane, and it worked really well; but we didn't end up using it in the film. Marty didn't ever design a shot based on, 'Oh, it would be cool to do this.' He was only interested if the shot was appropriate to the story. It was interesting trying to find a vocabulary to show him techniques that were available to him, but he was not interested in the gag for the gag's sake."

Legato commissioned miniature supervisor Matthew Gratzner at New Deal Studios to create miniatures for the film, engendering much excitement at the company. "It was the show that everybody wanted to work on," stated Gratzner. "Visual effects are now so often synonymous with digital effects; but there were so many shots in this film that not only were raw, in-camera model shots, they were in-camera model shots with first-unit action and first-unit actors! You just don't see that any more. This was a once-in-a-lifetime opportunity."

To build radio controlled flying versions of selected miniatures, New Deal collaborated with Aero Telemetry Corporation chief designer and flight engineer Joseph Bok – an avionics contractor who specialized in radio control flying drones used in military surveillance – supplying molds of miniature aircraft and loaning model crew members for construction and fine detail work. Special effects supervisor R. Bruce Steinheimer supplied full-scale mechanical effects rigs, working in collaboration with Craig Hosking.

To determine the extent of in-camera effects and potential digital enhancements, Legato met with the director in March 2003 and brainstormed shots using stock model planes and a lipstick camera. "Marty annotated the script shot-by-shot," remarked Legato, "incorporating his shot list with the narrative. We used the lipstick camera and various model planes on stands to show, for instance, how high a high-angle should be, and we pieced together sequences. Then, right there in Marty's hotel room, I thermal-printed the images and noted the script page and shot number, so that when I went to previz I had a record of all his ideas."

Legato set up a temporary base of operations at Sony Pictures Imageworks and worked with previsualization artist Oliver Hotz to develop 3D animatics. The animatics made use of Wheels, the virtual camera previsualization process that Sony had used on *The Polar Express*, which allowed real-time camera interaction in the CG realm. "I was editor and camera operator," explained Legato, "and Oliver was computer operator. We constructed shots from my notes and pictures, and pieced together sequences. Marty could then see if there was a plot hole and determine what else we needed."

Imageworks along with a handful of ancillary vendors, ultimately provided digital effects for a number of key sequences. "Sony did our heavy lifting," related effects producer Ron Ames, "CafeFX did our semi-heavy lifting, and independent contractors, sometimes single artists working out of their homes, did composite shots. That allowed us to be flexible for Marty and his editor, Thelma Schoonmaker. He'd say, 'Can you make it lighter, darker, faster, slower? – and we could do adjustments instead of making a big deal with a change order and going back through a big company pipeline, which is very expensive.'"

The film opens, after a brief introductory scene, with Hughes surrounded by his fleet of biplanes in 1927 Van Nuys, California, preparing to shoot the dogfight for *Hell's Angels*. Colors pop with startling brilliance – a blood-red German warplane contrasted against the golden hues of the desert terrain; and, in a later scene, Hollywood's art deco Coconut Grove nightclub juxtaposing fiery period lipsticks with aquamarine décor – the result of artful production design and a digital two-color emulation process.

The vintage Technicolor look was partly inspired by a sequence in *Hell's Angels*, where Hughes had used a dye transfer film process – impregnating layers of black-and-white film with colored dyes to create a limited color spectrum – for an eight-minute scene introducing blonde bombshell Jean Harlow to a glamorous ballroom scene. For early colorization experiments, Legato emulated three-strip Technicolor using black-and-white still photographs of a Pasadena



Director Martin Scorsese renewed his collaboration with actor Leonardo DiCaprio to bring the early years of industrialist Howard Hughes' life to the screen in *The Aviator*. Beginning with the production of Hughes' World War I aviation epic *Hell's Angels* in 1927, the movie avoided the much-chronicled later years of the millionaire's physical and mental decline, and instead focused on Hughes' enduring passion for moviemaking and aviation. Visual effects supervisor and second unit director Robert Legato joined the production to lend expertise in the re-creation of aircraft and aerial sequence effects, combining state-of-the-art digital technology with many period in-camera filmmaking techniques.

house and introduced three color filters – red, green and blue. “I used After Effects to recombine the images in a way the Technicolor guys had done in their labs using photochemical equipment,” noted Legato. “I then added yellow, magenta and cyan, and printed separations on transparency material on my Epson printer.”

Layered together and held up to the light, the transparencies emulated the saturated reds and greens of the three-strip process, and served as a tool for conversation with technicians at Technicolor Digital Intermediates who devised a method to translate the look to a feature film. “This was certainly one of the more extreme looks we had tried stylistically,” said Joshua Pines, vice president of imagery research and development at TDI. “It had to be at film resolution, full color gamma and full dynamic range, and we had hundreds of thousands of frames to handle in a short space of time.” Pines analyzed color separations and produced “3D lookup tables” to chart color conversions by sampling RGB space. “We sent a few thousand RGB triplets through a very precise algorithm, taking a few specific colors and seeing what happened to them on output, and built a color table in three-dimensional space. When we ran the final picture through, it interpolated pixels in this cube of 3D color space – we called it an ‘interpolated deformed lattice’ – and colors could interact.”

Director of photography Robert Richardson shot the film with conventional color film, then TDI colorist Stephen Nakamura introduced colors in live interactive sessions corresponding to the dyes Technicolor had used to create release prints. Full algorithms were then applied and color conversions refined in rendering. Two-color separations – used for scenes dating through to 1935 – required further research. Richard Goldberg, Technicolor research scientist and veteran of the dye transfer process from 1953 to 1965, offered his advice. “Dr. Goldberg told me that they added a ton of yellow dye to the magenta during the ‘imbibition’ process,” recalled Legato. “This imbibed the ink within the matrices of the film. After he described that to me, I went home that night and tried it on my printer. I printed out a transparency with this funny magenta color and sandwiched it with the cyan separation, and ‘Eureka!’ I had two-strip Technicolor. It would have been so easy for the Technicolor guys back then if they’d had After Effects and an Epson printer!”



In the second year of shooting *Hell's Angels*, Hughes used 87 vintage airplanes to film a thrilling aerial battle that tragically claimed the lives of three airmen. Seventy-six years later, Scorsese reenacted Hughes' live, in-camera sequence digitally. Rob Legato employed 3D previsualization to re-create shots from the original film's dogfights and then photographed DiCaprio in a cockpit set on a greenscreen-backed motion base. Sony Pictures Imageworks created environments by weaving together aerial textures of the California desert, projected into a 3D dome. CG artists added combinations of digitally generated and photographic clouds, then filled the skies with three styles of careening digital biplanes.

To help gauge color conversions on set, Legato took still photos of costumes, fabric colors and set designs, then created color reference tables in Photoshop and applied two-strip and three-strip color emulations, which became the basis for Joshua Pines' 3D lookup tables. “Marty could

then tell if he picked a certain red, it would look a certain way," Legato noted. "We separated colors using the same process we would use to pull redscreen, greenscreen or bluescreen mattes in After Effects. We then added one color on top of the other, using a slider to control density, and went down the line, filtering out the colors as if we were shooting with separation filters. We did that for every scene in the movie."

Scenes at Hughes' Hell's Angels base camp were shot in the latter part of the schedule in Santa Clarita, California, using 13 privately owned replica aircraft – German Fokker DVIIIs representing the Axis fleet, and British SE5s representing the Royal Flying Corps – and 1/5-scale radio controlled miniatures, created by the Aero Telemetry team, including DV11s, a De Havilland DH-4 and Sopwith Camel. To re-create a Hell's Angels liftoff scene – which featured an angle from a low-slung camera strapped to the undercarriage of a foreground plane – Legato had planned to expand the fleet using additional commercially available 1/4-scale radio-controlled models. "It was a great shot," stated Legato, "and my plan was to do it with 20 RC planes, because the models were only a couple of thousand dollars apiece – but the shot got killed. It was a heartbreaker for me, because I knew I could do it in-camera; all we would have had to do was add shadows. In the end, we used four of the models in a couple of scenes flying around like tiny flies in the background."

Legato shot takeoff scenes using six full-scale biplanes. "Only one plane could fly," Legato recalled. "When we tried to get that off the ground, we could only do two takes because we had so much to shoot that day; so I ended up using an aborted takeoff and adding computer generated planes."

Imageworks generated wide shots of the fleet in a high-angle view overlooking the airfield and in a lower level shot of the aircraft soaring skyward. The scenes included a digital version of a hero camera plane, a hybrid Sikorsky S-29, which New Deal Studios built in miniature. "Howard Hughes had his art department mock up a Sikorsky observation plane to look like a Gotha bomber," related Matthew Gratzner. "Our budget was fairly limited; so, instead of building it from scratch, Adam Gelbart – one of our lead modelmakers and a big radio-control airplane enthusiast – found this absolutely gorgeous, flyable model of a British Vickers Vimy in the Philippines for \$1,400, and we used that as the foundation. It had a 12-foot wingspan, which scaled out to roughly 1/4-scale, and we tore the whole thing apart."

Referencing research of British, German and Italian World War I bombers, Gratzner redesigned the plane, using previz to match distances between the wing, the pilot's head and motion picture cameras mounted on the upper wing and front of the aircraft. Modelmakers added hammered metal combing around the fuselage, then detailed silkspan fabric surfaces by adding fake stitching to seams, grommets and lacing across access panels, and painted and weathered all surfaces. Other details included fuel tanks



To stage the 1930 premiere of Hell's Angels at Grauman's Chinese Theatre in Hollywood, production designer Dante Ferretti erected a full-scale period theater façade on location in Montreal. Rob Legato shot some 300 extras and

fabricated from vacuform styrene, miniature Bell & Howell cameras fore and aft, and miniature castings of the pilot actor and Leonardo DiCaprio in flying helmet, goggles and leather jacket.

to stage the 1930 premiere of *Hell's Angels* at Grauman's Chinese Theatre in Hollywood, production designer Dante Ferretti erected a full-scale period theater façade on location in Montreal. Rob Legato shot some 300 extras and period vehicles in different positions around the set. Matte painter Robert Stromberg and compositor Paul Graf, at Digital Backlot, assembled the composite, adding photographic textures of additional buildings to the right and left of the frame, and nesting production photography into tiled plates of a miniature Hollywood Boulevard constructed by New Deal Studios. Sony Imageworks supplied three animated digital biplanes flying overhead.

Although originally designed for motion control photography, the miniature bomber served as valuable reference for artists at Imageworks, who scanned and photographed the model to detail their digital version. "We couldn't find any CG models or photos of Hughes' plane on the Internet," observed Imageworks digital effects supervisor Pete Travers, "so we absolutely had to rely on New Deal's model, and we built our CG model from lidar scans. It was a very tricky lighting environment in broad daylight, up in the sky. We studied photos of real biplanes in flight, and a lot of them looked fake because there was nothing to attach them to the background."

The CG aircraft blended into shots with lighting design initially dictated by live-action photography shot on a greenscreen stage at Hollywood Center Studios in Los Angeles. Bruce Steinheimer's team built a greenscreen cockpit buck, which DiCaprio rode in, on top of a six-axis motion base supplied by Mark Noel. The motion base was programmed using motion extrapolated from Hughes' original biplane choreography. "We tried to keep as true to Hughes' film as possible," commented Legato. "We based our dogfight previz on shots from *Hell's Angels*, depicting how somebody could have photographed this mêlée of fighters flying around in a three-dimensional environment; then we translated motion control from previz, which is a very difficult art form. Everything is relative to camera motion; so, for the actor and director, the camera moves might seem incomprehensible, but through the lens it made sense with the appropriate background."

Motion control supplier Camera Control converted previz to motion control data, calculating handoffs between the motion base rig and camera moves, then translated the data to a Milo rig



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on a 70-foot-long track that moved around the eight-foot-high motion control platform. "The setup took up an entire stage," noted Camera Control lead operator Simon Wakley. "We had 12 feet of travel left and right of the buck. If we needed to go further right, we spun the buck to the left and vice versa." Wakley's team synchronized backgrounds with camera moves on the greenscreen stage by creating double exposures with the previz backgrounds on set, giving Scorsese and DiCaprio a sense of the finished move.

Shots occasionally pushed the envelope of physical camera motion. "For one shot, we had to simulate a move flying our camera toward Leo at high speed," said Wakley. "The standard motion control trick is to undercrank the camera to a very slow speed, but that didn't work in this case because the shot was focusing on Leo's face and we did not want him to have to act in slow speed to match the camera speed. So we moved the cockpit on one track and the camera on another, and got 60 percent of the motion out of the cockpit and 40 percent out of the rig. Shooting at 18 frames per second, we simulated a move that traveled at 30 miles per hour and flew past Leo, inches from his face."

To accommodate the expansive motion control camera moves required for miniature shots, Wakley wrote custom software that allowed handoffs between previz and motion control camera data. "We could roll the Maya scene off the horizontal and import the previz move into our Flair motion control system," said Wakley. "The model could be mounted on its side or tilted at 45 degrees, and the previz move matched perfectly, with the horizon rolled in correct perspective with the miniature. This is the first time that I have used this feature of the software, but with some close coordination with Oliver Hotz, we could import and line up the move in only minutes."

Through the Hell's Angels battle, DiCaprio was three-quarter backlit with a high-key backlight. Moves that circumnavigated Hughes as the bomber whipped by camera featured handoffs to digital doubles of DiCaprio and the pilot, fashioned by Imageworks from cyberscans of the actors in costume. Imageworks generated all additional



New Deal Studios model crew chief Scott Schneider attends to a period miniature auto, one of 100 built for the production from model kits. Miniature vehicles were grouped and rearranged for different lighting passes on the 1/24-scale Hollywood Boulevard set.



New Deal modelmaker and lighting technician Kenny Nevarez details a miniature Hell's Angels sign using electroluminescent-wire neon. Other light sources included stepping-motor-controlled

aircraft digitally. Artists modeled a DeHavilland Tiger Moth to represent Allied forces and a Fokker DV11 to represent the Axis, and then rendered biplane surfaces using ambient and reflection occlusion. "The Hell's Angels planes weren't that shiny," commented Pete Travers, "but they still had a component of reflection response, which added to the realism. We also did quite a bit of modeling on the surfaces, making them dented and bumpy, to help when planes were close up."

roving searchlights, backlit miniature fluorescents and tiny practical lights dotted around the set.

Imageworks CG supervisor Dave Seager oversaw creation of all of Imageworks' CG elements, including the dogfight environment, which was created using aerial photography of terrain shot over Santa Clarita and photographic textures. "We started with the sky dome," commented Travers, "then moved to the land. We stitched together the photos, color corrected them, and used matte painting augmentation to fill in the desert and add vegetation to the ground. Then we added clouds." The clouds' sculpted, three-dimensional form was an important plot point for the sequence – selected by Hughes to create depth, speed and parallax in his dogfight. Travers' team elected not to pursue a volumetric approach to modeling clouds. "Voxel-rendered clouds tend to work in a stylized fashion. Our clouds had to look photoreal; and we did not feel it was possible to match the look of big, puffy nimbus clouds by mathematically sculpting them in 3D. Instead, as source textures, we used real clouds taken from our library and images shot above our studio, and then used our semi-volumetric renderer, Splat – developed for The Polar Express – with RenderMan's Deep Shadow technology to render soft shadows. But, ultimately, all the patterns and the textures were real clouds."

The 14-shot dogfight sequence featured a dizzying ballet of aircraft animation supervised by Pepé Valencia and sequence lead Keith Smith, at one point featuring a low-flying aircraft that narrowly misses Hughes, smashing a camera from his plane. "Marty learned from his research that this had really happened," said Legato. "I did some research of my own and used forensic logic to reason how this could have happened. The pilot didn't die, which meant the plane didn't rip the wing off, so the camera must have been rigged so that a wheel could hit it. In the silent movie Wings, I noticed they had a camera mounted on top of the upper wing. We figured out a way to fasten the magazine so it could be clipped off and the film would come out like spaghetti."

The impact was achieved using a full-scale New Deal model of the biplane's upper wing measuring eight and a half feet long and six feet wide, made of primed and weathered canvas stretched over wooden ribs, with a period camera attachment.



Filmed at Santa Clarita Studios, the Hollywood Boulevard model "which extended 80 feet in length and 10 feet in width" allowed the filmmakers to fill in portions of the Chinese Theatre and its environs not constructed in the full-scale set. Research from period photographs revealed details of surrounding architecture long-vanished from modern Hollywood, including the Hollywood Hotel, built on what was once known as Prospect Avenue. After New Deal dressed and lit the set, Legato used a locked-off camera to shoot multiple passes of motion picture tiles as searchlights panned back and forth.

"Rob asked us to imagine how a grip in 1928 would mount a camera to an airplane," explained Matthew Gratzner. "Nowadays, they would probably use a machined aluminum piece, but we built an antique-looking wooden platform with brass fittings and leather padding that conformed to the wing, and fastened it with heavy leather straps and cinch buckles." Miniature special effects technician Richard Stutsman rigged the wing on its side on a scissor lift, the camera looking up from below, attached a wire to the camera and drove the rig around the parking lot at Santa Clarita Studios. As the sun slid across the model, wind fans blew across the fabric of the wing and effects technicians yanked off the magazine. Imageworks later animated a CG plane to strike the camera with its undercarriage as the magazine detached, then added camera shake at the moment of impact.

New Deal also contributed miniature elements to enhance a re-creation of the May 30, 1930, premiere of *Hell's Angels* at Grauman's Chinese Theatre in Hollywood. The sequence begins with documentary footage colorized by Legend Films, then transitions with a digital film grain effect dissolving into production photography of Hughes arriving with Jean Harlow (Gwen Stefani), staged on a full-scale period theater façade, built in Montreal.

In wide shots of the street, displaying the theater, crowd and buildings all around, Legato staged production photography using 300 extras, shooting nine takes of the crowd and period vehicles in different positions around the set. New Deal then constructed a 1/24-scale miniature of the scene, referencing period architecture. "We photographed and measured the modern movie theater and surroundings," Gratzner observed, "but Hollywood Boulevard doesn't look today like it did in 1930. Rob showed us a book called *Los Angeles Then and Now* and the cover was of the *Hell's Angels* premiere. There was something back there in the shot we could not make out, so we did some research and discovered what was once the Hollywood Hotel. Built in 1902 for visiting prospectors, the hotel had a combination of Mediterranean architecture, clapboard sidings and a big tower that had a Spanish mission feel. We re-created that in our miniature, which was 80 feet long from front to back and 10 feet wide."

New Deal detailed the model with stepping-motor-controlled roving searchlights, backlit miniature fluorescents, electroluminescent-wire miniature neon signs, miniature stage lights shining onto the street, and 100 model kit cars grouped and rearranged for different passes. Legato shot the miniature at Santa Clarita Studios using a locked-off camera to gather motion picture tiles. Matte painter Robert Stromberg and compositor Paul Graf, at Digital Backlot, then assembled the composite from the tiled plates, adding photographic textures of additional



Hughes sets an air-speed record in his H-1 racer. Ground-based shots in the sequence employed a full-scale H-1 mockup engineered by physical effects supervisor R. Bruce Steinheimer. Aero Telemetry Corporation built a flying radio-controlled model for some shots. Shots demanding complex aerial choreography featured a digital H-1 generated by CafeFX, which built CG models in LightWave and used radiosity to simulate effects of light bouncing off the plane's highly reflective aluminum surface. High dynamic range images of the flight location, stitched together and mapped to digital geometry extracted from satellite data, served as backgrounds.

buildings to the right and left of frame and nesting production photography into the miniature theater façade with crowd elements and photography of full-scale cars. Imageworks supplied three animated digital biplanes flying overhead, motivating a tilt down to reveal the street below.

The next airplane in Hughes' life story is introduced as The Aviator romances actress Katharine Hepburn (Cate Blanchett), first landing a Sikorsky S-38 twin-engine amphibious aircraft at a beachfront film location, then later whisking the movie star away for an impromptu night flight over Los Angeles. For shots of the S-38 emerging from a cloud in the beachfront scene, independent CG artist Mark Wilson built a digital model of the aircraft. Don Lee, visual effects supervisor at Pixel Playground, then composited the model into a Vistavision plate, dissolving away layers of cloud as the plane appeared. Craig Hosking supplied a practical S-38 for full-scale shots of the beached plane and for the night flight sequence, shooting air to air, lit only by city lights and flames of the engine exhaust. Legato shot Vistavision cloud plates for window views inside the craft, composited into a greenscreen cockpit set. "Marty wanted the city lights to feel like jewels outside," observed Ron Ames. "He wanted it to have a magical quality, so we strove to reach an exact balance of movement and light outside the windows that did not detract from the scene. In a couple of shots, when Howard looks towards Kate, we also painted in very subtle sparkles in Howard's eyes."

During the romance, Hughes labors to perfect his first experimental aircraft – a sleek aluminum mono-wing bullet known as the H-1 Racer. Hughes' aircraft inspired a modern-day aviator, Jim Wright, owner of the Wright Tool Company in Oregon, to construct a full-scale working replica, which the production had planned to feature in the film. Tragically, Wright was killed while flying his plane over Yellowstone National Park, in August 2003, shortly before shooting, leaving the production with minimal time to find a replacement. "The only other remaining H-1 was hanging in the Smithsonian," related Bruce Steinheimer,



After losing oil pressure, the H-1 crash-lands into a beet field. CafeFX generated wide shots of the plummeting aircraft, together with composites of DiCaprio shot inside a greenscreen cockpit. Bruce Steinheimer's crew suspended the full-scale mockup from cables and cranes so that the jolting impact could be captured practically on location.



Camera operator John Skotchdopole secures a camera to get a closeup of DiCaprio riding the H-1 through a field of Swiss chard, simulating beets. Physical effects outfitted the full-scale H-1 mockup with galvanized metal skis and then towed it across the field, with DiCaprio on board, at speeds approaching 30 miles per hour.

"but we found a mockup that had been built as a background prop for The Rocketeer. I discovered it in a garage in Covina, but it was quite a decent piece – so it was a great find and a great saving to the production. We made it look like the real plane and put a three-phase golf cart motor in it, so it could zip around the airstrip with Leo sitting in it."

The visual effects department then faced the challenge of getting the H-1 airborne. "I wanted to keep with the style of the movie," remarked Legato, "so I basically transferred the money that we were going to use to rent the plane to build a radio-controlled plane, which we shot pretty much the way we would have shot the real one, from a helicopter."

In the space of six weeks, Aero Telemetry Corporation created a 1/2-scale, 16-foot-wingspan, radio-controlled prop-driven miniature of the H-1, built from a styrofoam sculpt and detailed by a team of New Deal modelmakers led by Adam Gelbart. "It was a carbon fiber composite spar structure," said Joseph Bok. "We built everything around that. Adam Gelbart came up with an idea to use aluminum tape to cover the fuselage; then we used the biggest military drone engine from our inventory and took on board every bit of our military technology, even some classified equipment, to make it safe." The 450-pound miniature H-1 performed aerial maneuvers for one day on location in the Santa Clarita Mountains, reaching speeds of 152 knots – 175 miles per hour – occasionally pulling five and ten Gs when coming out of turns. Bok controlled the aircraft's throttle while Aero Telemetry operator Jason Soames piloted roll, pitch, yaw and propeller pitch. "What killed Jim Wright was a propeller governor failure. Howard Hughes had a similar problem on his first flight of the H-1. We had the same problem. It was odd that all the planes had that issue."

For shots impossible to capture with the miniature, CafeFX visual effects supervisor Danny Braet oversaw construction of a CG plane and handled all cockpit composites for the sequence. "We'd always planned to use CG for certain shots," remarked Legato. "Shooting a miniature that reflective on a stage was impossible. We would have had to reflect the environment in the surface of the model in motion at all times, which was extremely difficult. CafeFX did a beautiful job of re-creating those effects using a CG model of the aircraft."

After achieving an airspeed record of more than 352 miles per hour, Hughes loses oil pressure in the H-1's Pratt & Whitney radial piston engine and crashes into a beet field. CafeFX generated shots of the H-1 nose-diving and pulling out of a flat spin. Physical effects then rigged the full-scale H-1 mockup for a practical crash landing piloted by DiCaprio. "Instead of doing it on a greenscreen," said Legato, "I wanted to shoot Leo inside the plane with the plane physically traveling. I was



Hughes' sleek reconnaissance plane, the XF-11, rolls out onto the runway for its fateful maiden flight. Establishing shots used a miniature XF-11 "16 feet long, with a 25-foot wingspan" built by New Deal Studios. The miniature aircraft was designed to be as robust and as detailed as possible to accommodate a variety of in-camera shots that integrated the model with live-action backgrounds via forced perspective. New Deal modeled the plane digitally, carved the form in urethane, then cast pieces in fiberglass, with a modular steel frame, and fitted twin, eight-bladed counter-rotating propellers that spun at 350 revolutions per minute.

trying to do as much practically as possible, so I suggested, "Let's just shoot the damn thing in a field,' and Bruce Steinheimer came up with a very clever rig."

Legato directed the second unit shoot in a field that the production had planted, months earlier, with red Swiss chard to simulate beets. Steinheimer's team rigged the H-1 mockup with skis made out of galvanized highway railings. "We cut the rails long enough to track through furrows in the field and pulled the plane along using movable pick points on an endless loop attached to a large truck," Steinheimer noted. "When the truck moved, it moved the plane, and the rails slid along the ground and sliced through the Swiss chard, throwing them up in the air. We got the plane up to about 30 miles per hour, with Leo riding inside. He was a good sport."

Hughes' aviation experiments win him a military contract to develop and produce the XF-11 - a futuristic reconnaissance aircraft with a bubble cockpit suspended between twin booms and counter-rotating propellers. First seen parked in a hangar, the plane was represented by a full-scale prop built for the production in Montreal, which was then given a digital makeover in postproduction. "The full-scale prop was built for a crash scene later in the movie," said Legato, "but it just didn't hold up for the hangar scene, where it had to look pristine. Oliver Hotz and Mark Wilson used LightWave to remodel and relight it, and reproduced the surface beautifully."

On July 7, 1946, the XF-11 rolled out of its hangar in Culver City, California, for a test flight that ended in disaster, almost killing Hughes, leaving him physically and psychologically affected for the rest of his days. Scorsese's production elected to stage the XF-11's flight and its visceral crash predominantly with physical and miniature effects.

Establishing shots of the XF-11 on the runway featured a New Deal Studios miniature built at 1/4-scale, measuring 16 feet long with a 25-foot wingspan. The impressive scale was determined by budgetary needs and options for the aircraft's fate. "When we bid the show," remarked Matthew Gratzner, "we considered building a 1/24-scale motion control model, a 1/6-scale crashing model, 1/3-scale insert pieces and a 1/5-scale radio-controlled version. Eventually we decided to make just one 1/4-scale miniature. That was huge, but



In-flight shots of the XF-11 were achieved with a radio-controlled miniature, which Aero Telemetry Corporation outfitted with four-bladed military drone engines "one that spun clockwise and the other that spun counterclockwise. Piloted by ground-based telemetry control, the aircraft performed takeoffs and landings using gyro-stabilized avionics and hydraulic landing gear.



For interior cockpit shots of Hughes firing up the XF-11, New Deal Studios mounted miniature engines behind DiCaprio on a partial mockup of the XF-11, atop a mobile physical effects rig. Forced perspective imbued the engines with an

my concern for using any smaller scales in the crash was that this was daylight, with contemporary, recognizable objects, and we did not want it looking 'model-y' in any way. The hardest thing about using miniatures in a period film is that there is no leeway. You can't make stuff up, as you can in science fiction or fantasy. It has to look accurate. Rob wanted to shoot miniature sequences as if we were photographing them live. It was big and it was heavy, but we got everything with one plane, and it was very first-unit oriented."

illusion of size, flanking Hughes as the aircraft charged down the runway.

New Deal crew chief Scott Schneider designed the XF-11 miniature in Rhino Studio 3D, creating slices through the geometry and printing cross-sectional templates. Modelmakers mounted the templates onto urethane foam, sculpted and assembled the XF-11 form, and then molded and cast a fiberglass core with a rigid steel frame that could be assembled in modular sections. "The wings could come off," said Gratzner, "the horizontal stabilizer in the back came off, the two rear booms came off, the center fuselage came off, the two engines came off, and we had doubles of everything. Every part was replaceable, because this had to act as our hero plane for all the closeups on the tarmac, zooming in with motion control cameras and in forced perspective, and it also had to work as our crashing plane."

For shots of the XF-11 emerging from its hangar and taxiing onto the runway – shot at the former Norton Air Force Base in San Bernardino, California – two New Deal modelmakers pushed the 1,000-pound miniature, rolling the aircraft above the head of second unit director of photography Phil Pfeiffer, who lay on the ground with the camera focused on the aircraft's wheel, framing reporters, technicians and mechanics observing in the background among an array of 1940s cars. "The cars were 600 feet away," remarked Gratzner, "but the compression of the lens made them feel much closer, and we captured the shot 100 percent in-camera. It was a classic forced perspective shot."



As the airplane approaches takeoff speed, the camera trucks alongside, overtakes it, then hangs back to observe as the craft soars skyward. Imageworks generated the takeoff entirely digitally. To create the runway environment, digital artists shot 360-degree plate photography at an airport in Palmdale, California, projected image tiles into a digital sky dome, and enhanced the setting with 3D atmospheric details. Imageworks also animated the digital XF-11 in subsequent high-altitude scenes of the plane in flight, and handled greenscreen composites of DiCaprio in the cockpit.

Forced perspective also played a part in shots of Hughes inside the XF-11 cockpit, flanked by the aircraft's sinister eight-bladed propellers. Bruce Steinheimer's team created a full-scale central fuselage section of the XF-11, built from a Lockheed P-38 Lightning cockpit fitted to the dimensions of the XF-11, and mounted the mockup 12 feet above the ground on a mobile rig. New Deal then positioned the 1/4-scale XF-11 engines either side of the cockpit above and behind the canopy. Aligned to a wide-angle lens perspective established by previsualization, the engines appeared to flank DiCaprio as they roared to life, the camera panning back and forth between them. "From the outside it looked absurd," Gratzner observed. "We had this giant

fuselage with two dwarf engines. But when Bob Richardson looked through the eyepiece, he said, 'Wow, I guess that works!'"

New Deal mechanical effects supervisor Robert Spurlock and effects technician Roland Loew engineered the XF-11 propellers using a 24-volt DC motor in the back of each engine connected to a series of gears that drove an inner and outer shaft, spinning the counter-rotating four-and-a-half-foot blades at 350 revolutions per minute. The mobile XF-11 rig then drove at speeds of up to 50 miles per hour, providing in-camera shots over DiCaprio's shoulder as he raced down the runway. For angles encompassing the rear of the aircraft, Legato abandoned plans to rig miniature booms in a similar forced perspective, due to lack of time on set, and Imageworks completed reverse angles with digital extensions.



With its starboard engine failing, the XF-11 descends over residential Beverly Hills, falls short of an emergency landing site on a golf course and plows into several homes. For a high wide angle of the aircraft's low-level approach, matte painter Robert Stromberg digitally enhanced a production plate, adding residences and the horizon line beyond the central crash zone. All other elements in the shot " were captured in-camera through the use of New Deal miniatures and digital rig removal.



New Deal Studios erected the miniature XF-11 crash site in a parking lot adjacent to the Van Nuys Golf Club, covering an area of 120 by 50 feet. Modelmakers built four miniature homes and additional closeup insert pieces for impacts, utilizing breakaway materials that plugged into the main wooden structures. Yards were dressed with miniature garden furniture, colored water in

swimming pools, and varieties of living and artificial trees. The elevated set was aligned with natural scenery and neighboring homes to create an in-camera, hanging miniature effect.

Imageworks also created a fully digital XF-11 for shots racing along the runway, allowing the camera to dip below the nosecone and rotate around the aircraft as it soared skyward. "We had half a dozen shots of full digital environments of the XF-11 taxiing and taking off," stated Pete Travers. "Wherever possible, we tried to find source photography to build our digital environments. We visited a runway at Palmdale Airport, filmed some 360-degree photography, and stitched it all together as our outside perimeter sky dome. We then created closeups of the runway with tumbleweeds blowing by in 3D."

Scenes with the airborne XF-11 featured a radio-controlled miniature engineered by Joseph Bok and his team, and derived from New Deal Studios' molds. Aero Telemetry outfitted the radio-controlled XF-11 with two military drone engines.

One engine rotated clockwise, and the other rotated counterclockwise, with gyro-stabilized avionics for added stability, and fully functional hydraulic landing gear, resulting in a telemetry-controlled craft that weighed 750 pounds and could reach air speeds up to 172 miles per hour. New Deal detailed the exterior of the flying model to match the hero plane and Legato filmed the miniature in the skies above Norton Air Force Base.

Cloud cover, however, rendered the Norton shots unusable, so the production relocated to Catalina Island Airport. "Catalina was perfect because it gave us a very high vantage point," said Legato. "As soon as the plane took off, we could shoot across it; and when we saw the valley below, it appeared to be flying a couple of thousand feet in the air. It is very unusual for an RC plane to attain that altitude, because they simply can't get up there." Aero Telemetry pilot Billy Hempel took position with Legato on the Catalina runway and flew the miniature at an elevation of approximately 100 feet. Craig Hosking meanwhile piloted a helicopter, capturing air-to-air shots 2,000 feet above sea level, guided by a thumbnail shooting plan. "I knew we needed shots with water in the background and others framed against the mountains. We tried to avoid front lighting, shooting near or towards the sun for dramatic effect. Other than that, it was very difficult to choreograph that kind of photography - the helicopter might sink while the plane rises - so my general guideline was: 'Here are the shots we have to get. Go up there and make like you're making an XF-11 commercial.' The helicopter pilot and camera operator were



To fly the XF-11 through the crash-site set, New Deal Studios mounted its half-ton miniature plane on an extendable dolly, attached to a cantilevered boom. The rig, connected to a steel cable loop and propelled by a heavy-duty motor, rode along a 100-foot length of Tiffen track. When an operator threw the switch, the plane hurtled down the track, its propellers whirling. Reaching velocities of 20 feet per second, it crashed into designated portions of the set while multiple cameras captured the series of impacts. Digital artists later removed any visible supports in frame.

very experienced in that style of photography, and they went to town while I operated a camera on the ground, panning back and forth. We had a really great day.”

The serenity of Hughes' flight is interrupted by an explosion that cuts power in the XF-11's starboard engine and sends the aircraft plunging in a rapid spiral over residential Beverly Hills. Legato designed the path for the XF-11's harrowing descent and impact by piecing together public records of the event. "I tried to reconstruct what happened from a couple of different sources," recalled Legato. "History is only ever recorded by subjective viewers, and opinions and judgment can be wrong, so I studied photographs, written accounts and Howard Hughes' own recollections, wove them all together and made a chart of events. We knew what direction he was heading, trying to land on the ninth hole of the Los Angeles Country Club – that gave us our trajectory. We knew what houses he hit and how he hit each house. The landing gear first hit the top of 803 North Linden. The wing struck the next house at 805 North Linden. That spun the plane around, and then he landed with the nose facing down an alley at 808 North Whittier. It was like using historical forensics to plot a move on a computer – we started here, ended here and figured out the 'spline' in between."

Hotz and Legato developed previz for the crash, evaluating methods to realize the sequence. "I always knew we were going to shoot the XF-11 crash as a miniature," stated Legato. "I showed Dante Ferretti my forensic breakdown, what angles we were going to cover, where the plane was going to land and, after Marty's approval, we locked into exactly what we were going to build. Dante constructed his set based on what I was planning to photograph as a miniature."

Previz removed any thoughts of staging the miniature crash as a single event covered with multiple random cameras. "Rob designed the sequence with very specific choreographed action," observed Matthew Gratzner. "He approached the sequence like a filmmaker, in the context of the story, rather than just as an effects shot. We decided we could shoot this similar



The aircraft's starboard wheel shatters the roof of a Beverly Hills home. The modular design of New Deal Studios' miniature XF-11 allowed portions of the prototype plane to be disassembled for more manageable closeups. Attached to the model crash rig, the miniature engine and undercarriage were propelled through a specially extended breakaway portion of the roof.



Inside the home, on a studio set, Rob Legato filmed a stunt performer who reacted to the appearance of the intruding wheel. Bruce Steinheimer's crew then imploded the ceiling with a full-scale wheel. Digital Neural Axis blended the performer and the wheel in a final composite.

to a helicopter crash we had shot for Terminator 3 with a model helicopter on a dolly. We ended up building a whole new dolly, because it had to be much longer and much bigger.” Robert Spurlock built the XF-11 crash rig as a cantilevered boom that supported the 1,000-pound plane on an extendable dolly platform. The rig rode along a 100-foot length of Tiffen track, attached to an endless loop of 1/4-inch steel cable, propelled by a robust 15-horsepower alternating current permanent magnet motor. “We had a big on/off lever with ramp-up and ramp-down speed, with a heavy braided nylon line with bungee as an emergency brake. We needed 25 feet to ramp up to 20 feet per second. The plane zipped down the track on this dolly and crashed into whatever we put in front of it.”



To effect a severed XF-11 engine smashing into a kitchen window, New Deal Studios constructed a miniature kitchen interior and, in collaboration with miniature physical effects supervisor Richard Stutsman and his crew, swung a burning engine on a cable into camera. Miniature houses served as backdrop for the view through the window. The visual effects team later composited a bluescreen foreground element of a woman darting from the impact. Assistant cameraman A.J. Raitano prepares for the interior kitchen shot while miniature effects technicians Roy Goode and Roland Loew dress the set at Santa Clarita Studios.



The XF-11 wing slices through the side of a home. Filmed during the Van Nuys miniature shoot, the shot incorporated a miniature likeness of DiCaprio as Howard Hughes inside the scaled plane. New Deal fitted the puppet with a throat microphone, headphones and cotton shirt, and installed a radio-

controlled motor in the neck to motivate a head-turn. As the plane ripped through a breakaway section in the miniature wall, the miniature physical effects team detonated shotgun mortars behind the building, exploding windows, lath and debris in time with the impact of the wing.

For the miniature crash site, New Deal built four 1/4-scale Beverly Hills homes and several additional 1/4-scale insert sections for impacts. "For any area that needed to break away in the impact, we inset a plug made out of breakaway materials," said Gratzner. "For breakaway walls, we built the miniature like a real stud wall, with balsa wood studs and little tiny pieces of lath, tar paper and wires."

The miniature houses and grassy surroundings filled a 120-by-50-foot area, complete with backyards, a swimming pool, 1/4-scale garden furniture and foliage. New Deal rented 12 living ficus trees to dress the background and built 30 midground trees from artificial plant material and two 1/4-scale hero trees for the foreground. The miniature blended into a live-action location at the Van Nuys Golf Club. "Anytime we saw between our miniature houses," related Rob Legato, "I wanted to see trees and grass and residential buildings in the background. We also needed an area that gave us enough physical space to work in, where we could confine all our explosions and clear them with authorities. I wanted the sequence to be backlit, which meant the set had to be facing due south – so no matter what time of day we were shooting, the sun would be behind the miniature. We set up in a parking lot across from the Van Nuys Golf Course, using the golf course as our backdrop, and bolted our track into place. We had plenty of room for our trucks and filming equipment, and it was an ideal hanging miniature set."

The crash sequence began with Imageworks digital composites of DiCaprio inside the full-scale XF-11 cockpit, composited into Vistavision aerial plates of Los Angeles, and wide shots of the CG aircraft dipping and plummeting in a flat spin. For aerial views bearing down on the crash site, the production staged a remote-controlled, wire-flown Spydercam shoot skimming rooftops at the actual location. "The Spydercam was programmable, like motion control," explained Legato. "I could shoot a run looking forward, a run with the camera pointed to the left, a run pointed to the right. We then stitched together moving motion picture tiled plates, which allowed us to pan and tilt inside the cockpit when we shot Leo bluescreen." The Spydercam team erected a 250-foot crane on location, strung cables to the impact zone at Linden and Whittier and ran the camera down the cable at 70 miles per hour. "It was pretty damn fast. We undercranked the camera so it went like a rocket, and it hit the mark every time."

The production blocked off the location for shooting, dressing in a scattering of extras and period cars. Imageworks then digitally removed anachronistic architecture. "We painted out any buildings erected after 1950," stated Pete Travers, "including high-rises on the horizon – but it was surprising how little the crash area had changed."

The XF-11 fails to maintain altitude, falling short of the Wilshire Country Club and hitting the roof of 803 North Linden with its starboard landing wheel. For a closeup of the impact, New Deal built an elongated miniature section of the roof, dressed with breakaway effects. "We

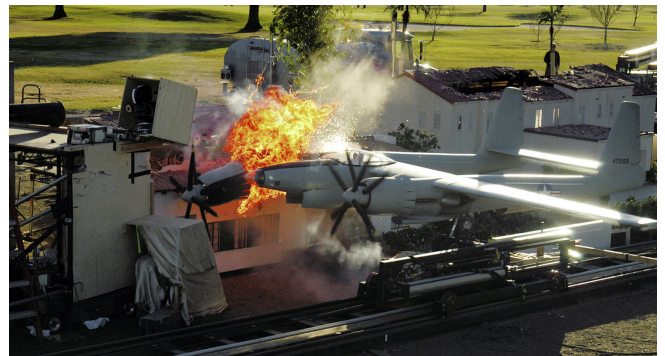
sculpted a pattern of Spanish tiles two feet wide by four feet long,” related Gratzner. “We made six RTV closed molds, to create the correct scale thickness, filled them with plaster and had two guys cast roof tiles repeatedly for two and a half days until we had 80 sections. We pieced them together on miniature balsa wood joists and planking, with a pre-broken groove for the wheel to go through, then stitched the tiles together with urethane foam and shot that four times in half a day.”

Inside the house, the wheel crashes through a bedroom ceiling. Bruce Steinheimer’s team rigged the effect as a full-scale physical effects gag, shot at Santa Clarita Studios. Legato shot the effect at 96 frames per second, and shot a separate element of a housewife cowering in terror in the foreground of the shot. Visual effects subcontractor Digital Neural Axis then composited the elements, with a 400-percent speed change, rotoscoping and tracking the housewife into the shot and using paint effects and deformation to match the plates, with animated camera shake.

Other house interiors were achieved with combinations of miniature effects. “We built a 1/4-scale interior hallway,” said Gratzner. “It had a set of stairs, a wood floor and doorway, dressed with period pieces. One of our modelmakers built a beautiful 1/4-scale version of a 1932 radio I owned. We had a practical lamp on a desk and period photographs on the walls – that’s my family from the forties, with pictures of my grandfather, my great-grandfather and the shallow gene pool of the Gratzner family in miniature picture frames. Rob wanted a constant harmonic vibration to shake the pictures and one of them to fall, so we used a simple pin-release to drop one picture and rigged a Sawzall electric saw to the set to create an in-camera vibration. Rob later shot a greenscreen element of a man standing on a scaffold, walking out of the doorway then ducking as the wing ripped through.”

To propel the wing tip through the interior wall, Scott Schneider affixed the miniature XF-11 wing to a forklift truck and drove the prop through the set in Santa Clarita. For the exterior view, shot in Van Nuys, New Deal rigged a multi-layer wall filled with miniature balsa studs, tar paper, plaster and additional debris. Richard Stutsman’s team then mounted shotgun mortars behind building windows and triggered detonations to shatter the glass in time with the impact of the airplane as it sliced into the house like a knife gutting a fish.

The impact causes the wing to tear away from the XF-11 fuselage. New Deal constructed a special breakaway wing for the effect, built with a steel airframe and two hardwood spars rigged with primer-cord cutters, covered with annealed sheet aluminum and sealed with epoxy resin. As the wing detached, the counter-rotating propellers



When it strikes the house, the XF-11’s wing is ripped from the fuselage. New Deal Studios fitted the XF-11 with a breakaway wing for the effect, joining the wing to the fuselage with hardwood spars rigged with primer-cord cutters. As the wing detached, the propellers continued to rotate, tearing the wing free. New Deal mechanical effects supervisor Robert Spurlock engineered the detaching engine effect by installing a retaining ring and an air cylinder that, triggered by a pyrotechnic charge, blew the engine from its mount.

continued to rotate, smacking into roof tiles and tearing the engine free. "Bob Spurlock engineered the motor with a big retaining ring and an air cylinder inside," said Gratzner. "Richard Stutsman rigged a pyro trip with explosives and, as the blades were spinning, he popped the engine - which ejected with huge explosions and sparks - and the counter-rotating propeller flew off over the roof. The first time we did it, we were scared shitless!"

Legato covered the detonation on the Van Nuys set with multiple cameras running at speeds ranging between 48 and 60 frames a second. Just visible in frame, the cockpit featured a 1/4-scale likeness of DiCaprio, sculpted by New Deal modelmaker Clay Sparks, outfitted with a throat microphone, headphones and cotton shirt. A servo motor in its head, triggered at appropriate speeds, simulated Hughes' head turning as the airplane whipped past camera. Visual effects Flame artist Brian Battles digitally eliminated any traces of the rig supporting the plane.

The jettisoned engine is then seen from inside a kitchen, shot in Santa Clarita at 1/4-scale, with counter tops, cups, mugs, plates and glass-faced cabinets matching a full-scale set. "We had two cameras looking through the miniature window," said Gratzner. "We set up one of the other houses with a backyard and trees behind that; then Richard Stutsman's crew took one of our engines with the props all seized up and bent, hung it on a cable and swung it like a pendulum into the window." Legato shot a bluescreen element of a woman diving for cover, which Brian Battles composited into the foreground of the shot.



For the aftermath of the XF-11 crash, the filmmakers switched to a full-size mockup of the plane, shot on location in Palos Verdes. Special effects technicians rigged the location with soft cement breakaway materials and 7,000 feet of pyrotechnic tubing, through which the team pumped benzoyl peroxide to create a controlled burn.

Outside, a high-angle shot looking down on the plane, with the neighborhood beyond, incorporated the only digital matte painting in the sequence, generated by Robert Stromberg and composited by Paul Graf. Closeups of Hughes rattled in the cockpit featured DiCaprio riding the greenscreen gimbal rig, composited with swirling backgrounds created from shots of miniature houses grouped in a circle around a central rotating camera.

The plane crashes into an alleyway where the remaining wing collides with a telephone pole, spinning the aircraft around while severing its remaining wing and obliterating the pole as fuel tanks explode. New Deal outfitted the impact zone in Van Nuys using two miniatures configured to represent the rear of houses on Linden and Whittier, another building under construction in the background, and mounted the miniature XF-11 on a pneumatic turntable at the lowest elevation of the dolly. Richard Stutsman's team hollowed out a dummy telephone pole, filled the cavity with primer cord, and rigged flame bars and pyro mortars around the set. New Deal then ran the aircraft down the track and Stutsman's team detonated the explosion, shattering the pole and sending flame and debris into the air as the aircraft spun around.

The miniature intercuts a full-scale mockup of the wingless, burning XF-11 dropped on a cable from an overhead trolley, rigged on location in Palos Verdes by first unit special effects supervisor Rick Thompson. To enhance the aircraft's death throes, Stutsman's team rigged the miniature XF-11 in Santa Clarita, dropping it off a Gradeall crane. "We lit the miniature on fire," recalled Gratzner, "set the left engine spinning and dropped it from 40 feet in the air. It came spiraling down on fire and, as it spun, we triggered the second engine, which exploded off, coming right at camera. It then jump-cut to the nose of the full-size mockup hitting a wall - and that finished the sequence, 99 percent of which we shot in one week."

For the full-scale aftermath, where Hughes miraculously escapes the wreck, special effects location foreman Phil Cory rigged the Palos Verdes set with soft cement breakaway materials and 7,000 feet of pyrotechnic tubing. Stunt coordinator Doug Coleman then staged a full-body burn effect, seen as Hughes is momentarily consumed by burning aviation fuel. "It looked a lot hotter than it was," said Bruce Steinheimer. "We used benzoyl peroxide, which is an oxidizer that burns with a flame that looks really hot, but it's actually quite cool."



Shots of Hughes within the flame-licked cockpit were also achieved live and on location, with Leonardo DiCaprio's stunt double standing in for the actor as the effect crew executed a series of propane explosions. To ensure that the plastic cockpit canopy did not melt from the heat and jeopardize the stunt double, crews carefully monitored temperatures using a laser pyrometer.

Hughes survives the crash to doggedly pursue a canceled military contract, self-financing production of the largest aircraft in its day, the leviathan HK-1 Hercules seaplane, which Hughes' critics derogatively labeled the 'Spruce Goose.' "The Spruce Goose was not made of spruce," remarked Legato. "It was actually made of birch and balsa, with very little spruce, but 'spruce' was something to rhyme with 'goose,' so that was what Howard's critics called it to piss him off. But it was literally painted wood, and that was what was difficult about this aircraft - it looked like a prop from some 1950s science fiction movie, like a spaceship made of wood, painted a fake metal color. It was very difficult to make it look believable on screen, even if we made it look exactly like the real thing - because the real thing looked fake."

With the real Hercules residing at the Evergreen Aviation Museum in Oregon, the production set about creating a mockup of a section of the aircraft, with a forced-perspective tail, used for first-unit shooting in Montreal. Legato then created wide shots and flying scenes of the silvery metallic behemoth in miniature. "I wanted to use a miniature to give us realistic reflections," explained Legato. "The reflections did not have to correspond exactly to the scene, but they would be appropriate enough to reflect the world around the aircraft, and we then filled in the environment. I wanted to shoot the Hercules miniature in natural daylight because if we had tried to photograph it indoors we would have had to surround it with a scenic backdrop, which would have been flat-lit and too generic."

Miniature construction began with a reconnaissance mission to Oregon, where the museum staff gave New Deal Studios access to Hughes' Hercules for two hours before general public admission one morning. "I climbed up on the flight deck, took measurements and approximately 900 digital stills," said Matthew



After barely surviving the XF-11 crash, Hughes goes on to build the largest aircraft of its day, the leviathan HK-1 Hercules seaplane. Though full-scale mockup sections of the plane, fitted with a forced-perspective tail, were constructed for main-unit shooting, wide shots featured a nose-to-tail Hercules miniature built by the New Deal team. Modelmaker Scott Shinkle assembles the Hercules wing.



New Deal visual effects supervisor Matthew Gratzner observes as crew members attach the 20-foot-long wing to the Hercules model. To ensure authenticity, Gratzner took several hundred reference stills of the actual 'Spruce Goose,' on display at Evergreen Aviation Museum in Oregon.

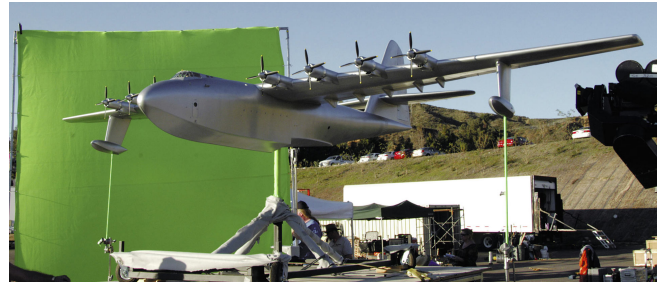
Gratzner. "As soon as I walked in, I realized it really didn't have any panel lines. It was seamless!" Hughes' engineers had produced the streamlined surface using a manufacturing process called 'Duramold,' which involved layering thin veneers of plywood with formaldehyde-based resin, coating the surface with adhesive rice paper, varnishing a mixture of aluminum powder and lacquer, then a clear varnish on top. The resulting finish presented modelmakers with very little opportunity for creating illusions of scale by adding imperfections – until Gratzner took note of a subtle detail in the giant structure. "This plane was 60 years old, so I knew that some of the warping of the wood and rippling effects probably were not there when Howard Hughes first built it. But when we studied the old photographs, we could see ribs along the fuselage. It was seamless, but it was so damn big – a 320-foot wingspan and 219 feet long – it was not a perfect tube, and the light would catch revealing ripples in the sides."

To replicate the subtle deformations in miniature, Scott Schneider first modeled the basic form of the Hercules in Rhino 3D and output four-inch-thick, 1/16-scale cross-sectional slices for sculpting in urethane foam. Modelmakers sealed the surface with primer, then layered the form with six-inch-wide strips of aluminum tape, creating the scaled appearance of laminated plywood. Moldmakers coated the aluminum in an RTV silicone skin; then, instead of jacketing the mold in rigid fiberglass, coated the RTV with urethane foam, which expanded and accentuated imperfections in the sculpt.

The 20-foot wingspan miniature could be mounted from the top or bottom, and featured stepper motors that drove the eight propellers.

Modelmakers detailed the few areas that required rivets, around the engine cowlings and the interior of the door, and added tiny wooden straps and a 1/16-scale flight deck with seats containing miniature likenesses of Hughes and his meteorologist, Professor Fitz (Ian Holm). Adam Gelbart detailed instrument panels using Gratzner's photographs of the Hercules' dials, reduced and affixed to dimensional surfaces to create an exact representation of the instrumentation of Hughes' aircraft.

Lead painter Leigh-Alexandra Jacob brought historical accuracy to the aircraft's distinctive paint job, assisted by inside information from the Evergreen Aviation Museum. "The plane in the museum didn't have the real reflectivity that the Hercules originally had," Gratzner observed. "The exact formula was one part metal powder to three parts lacquer, and in the museum they did one part metal to five parts lacquer, which ended up an almost grayish gunmetal color. We wanted our Hercules to look as authentic as possible, so we scaled back weathering and made it look brand new." Further evidence of the aircraft's sheen appeared when New Deal lead carpenter Brandon Seifert, a second-generation aviation buff, unearthed



To capture natural daylight reflections on the plane's surface in aerial sequences, Legato shot the completed Hercules model on an outdoor greenscreen motion control rig. New Deal modeled the plane in Rhino 3D and output cross-sectional slices in birch and balsa wood. Modelmakers layered the underlying form with strips of aluminum tape, creating the scaled appearance of laminated plywood. Moldmakers coated the aluminum in silicone skin, then applied a layer of urethane foam to accentuate imperfections in the sculpt and thus enhance scale. The miniature could be mounted from the top or the bottom, and featured eight stepper-motor-driven propellers.

his father's copy of a rare color documentary, *Hughes and His Aircraft*, which depicted the Hercules being rolled out of its Culver City hangar. "That was the final proof of the reflectivity. It was really shiny, with all the reflections of the street. When we showed it to Rob, he showed it to Marty, they found the original footage, scanned it, cleaned it up, and it ended up in the movie."

The Hercules is first seen under construction in its hangar at the Hughes Aircraft Company. The production shot first-unit scenes in an abandoned railroad manufacturing plant in Canada utilizing the forced perspective mockup of the massive aircraft. For wide shots, New Deal constructed a skeletal Hercules subframe using its computer model to generate CAD renderings of the wing and fuselage, which a laser-cutting service employed to cut the airframe. Modelmakers then laminated the 1/16-scale fuselage with birch strips and fabricated a miniature scaffold to support the structure inside a 20-foot-long, 5-foot-tall miniature hangar, built from local reference. "The production shot hangar scenes in Canada, because another production was occupying the real Hughes hangar," explained Gratzner. "The real hangar was only a short drive from our studio, so we took about 300 photos of the actual location and built an amalgamation with the Canadian set, blending the real Hughes hangar into the roof above the Hercules."



The Hercules is first viewed under construction in its hangar at the Hughes Aircraft Company. The production filmed first-unit scenes in an abandoned railroad manufacturing plant in Canada, utilizing the forced-perspective mockup of the massive aircraft. Wide shots were achieved with a skeletal Hercules model parked inside a miniature hangar set. For reference, New Deal Studios shot photos of the real Hughes hangar "located near their shop" then re-created elements of the huge structure in the 20-foot-long, five-foot-tall miniature. The final set was an amalgamation of the real Hughes hangar and the location facility in Canada. Modelmaker Mike Fuchs details the roof of the hangar miniature.

Legato inserted the miniature into a scene where Hughes walks by the aircraft with TWA president Jack Frye (Danny Huston). The actors were shot as motion control elements, then Camera Control repeated the move on the miniature. Don Lee of Pixel Playground composited the elements with additional greenscreen workers on scaffolds and sprays of sparks raining down. New Deal reused the hangar miniature for a later scene, conceived in postproduction, of the Hercules standing desolate and half-completed. "We redressed the hangar," Gratzner elaborated, "added little piles of sawdust, saw horses and planking and a little bit of smoke for atmosphere, with light coming in through the windows. Rob shot that with the camera on a dolly as a beautiful, in-camera shot."

For the film's finale, the Hercules is seen finally complete, floating in Long Beach Harbor, November 2, 1947, the day of its maiden flight. Legato shot the miniature dry-for-wet, in the parking lot at Santa Clarita Studios, with a Camera Control move jibbing down and tracking around the aircraft, revealing it in all its pristine glory. Devised from previz, the motion control move provided Imageworks with data with which to plot a 3D camera move, navigating a digital environment that incorporated synthetic water, interactive reflections and a digital matte

painting of the coastline by Robert Stromberg. "We used an overhead map of Long Beach to plot where the Spruce Goose was going to go in all the shots," said Pete Travers. "Based on the previz, we set up the camera move in Maya and plotted out a layout for the landmass and water. We then handed that to Rob Stromberg, who took some photography of current Long Beach and used that to create a 2½D matte painting as our main environment, correct for the period, stretching all the way to the mountains of Palos Verdes in the distance."

Imageworks blended the physical Hercules model into the environment, retaining the sky and natural reflectivity in the miniature from the original plate, and then used digital geometry corresponding to the dimensions of the aircraft to set the aircraft into water in the harbor. "The tricky thing about all the Hercules composites was that the plane and the water were both very reflective," noted Travers. "When the plane was on the water, it had to interact with the water, so we matchmoved the miniature plates and put that data into our water simulator to create the wake and displacement effects. We then rendered a digital version of the plane to cast a reflection in the water and rendered caustics to cast reflections of the water on the plane."

Imageworks effects animation lead Ryan Laney generated all Long Beach Harbor water digitally, procedurally modeling the undulating surface and using painted texture maps to break up the topology and create illusions of depth. "Wind and currents and the sheen of oil on the water all create dramatic changes in the topology of the ocean in real life," said Travers. "We spent a lot of time working on texture maps to make the water more organic, creating areas where the surface of the water was very different from one side of the shot to the other." Lighting effects added to the realism, including chromatic aberrations in specularity passes, which created shifts of color in highlights where the sun hit the water, and shadowing effects – where the plane shadowed the water and water shadowed the plane – revealing surfaces below the water. "We rendered the water using RenderMan's new ray tracing capability to create a refraction pass from an elevation map, revealing shallow areas. We used all the bells and whistles to break up the water so that it didn't look like a completely uniform surface."

For scenes of Hughes and his flight crew inside the aircraft, Scorsese shot his actors seated in a cockpit set that pivoted on a 48-by-30-foot gimbal engineered by Bruce Steinheimer's Montreal physical effects foreman John McLeod. "We controlled the gimbal motion in real time," explained Steinheimer. "We mainly rocked the set a little left and right, but Marty really wanted to capture the drama of the aircraft hitting the waves just before takeoff, so we introduced



To incorporate people into the hangar shots, performers were photographed using motion control "with those camera moves then repeated on the miniature set. Pixel Playground composited the elements and added greenscreen workers on scaffolds and sprays of welding sparks raining down. For a later sequence "conceived during postproduction "in which the Hercules stands desolate and half-completed, New Deal redressed the hangar miniature, adding sawdust, wood planking, saw horses, and smoke to create atmospheric lighting.

some up-and-down motion with a big hydraulic pump. It knocked the director of photography off his feet twice.”

DNA composited greenscreen window views into 53 Hercules cockpit shots using a variety of elements that included Vistavision helicopter plates shot in Long Beach Harbor and Robert Stromberg’s matte painting of the period location. “We used combinations of real footage and CG water created in Areté Psunami, composited in After Effects,” stated DNA visual effects supervisor Darius Fisher. “Some shots were all real footage, some were augmented with elements from the matte painting, some with Psunami water.” The lengthy sequence required careful color balancing between background and foreground elements and their shifting color values. “The challenge was to keep the original photography pristine and match the backgrounds – keeping every background consistent with the color bias of the foreground plate, which was different for every setup – so the elements tracked together when finally color-corrected at the digital intermediate stage.”

Imageworks generated composites of all exterior views of the Hercules as it powered up, kicking up sprays of foam, approaching takeoff speed. With documentary footage of the historic event prominent in public records, the visual effects team elected to tap the source material by scanning original newsreel footage, then tracked the shots to program CG cameras, reproducing 1947 camera motion. “Most of the shots of the Hercules, especially flying overhead, were taken from a boat,” said Travers. “Standard algorithms for camera shake are not very organic and don’t quite work to simulate a camera operator trying to balance on a high-speed boat that is trying to keep pace with the Spruce Goose. We tracked in all that motion, and it worked out great for a lot of our shots.” Imageworks rendered interactive water effects in Splat, with close attention to water dynamics. “The Spruce Goose was so large, the signature of the spray was crucial to sell the scale of the plane – the roiling-up of the wake, the wake pushing out, displacing in front of the hull, going from ‘chunky’ water to a misty spray, spray reflecting on the water, spray emitted off the displaced wake. We took as much reference as we could of how the water behaved directly from stock footage.”

Reaching liftoff speed, the giant Hercules rises 33 feet above the water. Imageworks generated the shot using a motion control miniature element composited with interactive water effects and a flotilla of digitally generated tugboats and press launches. Once airborne, the aircraft was photographed in all its glory as a self-propelled miniature, engineered from New Deal Studios molds and piloted on location in Long Beach Harbor by Billy Hempel, with Joseph Bok controlling the engines. Aero Telemetry Corporation constructed the flying miniature Hercules using molds of New Deal’s fuselage, with a slightly wider wingspan to enhance aerodynamic lift. Eight brushless electric motors propelled the



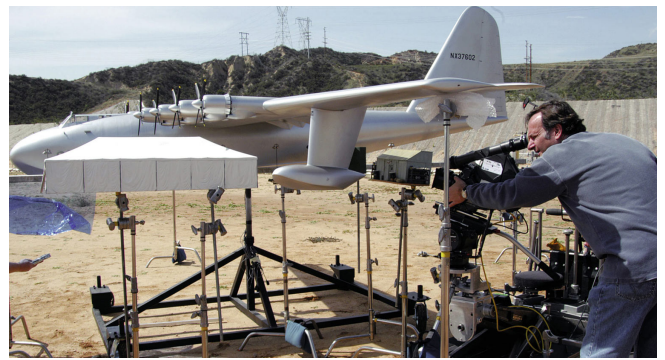
In the film’s finale, the massive seaplane takes off for its maiden flight from the surface of Long Beach Harbor. Rob Legato shot the miniature dry-for-wet, motion control, in the parking lot at Santa Clarita Studios. Sony Imageworks replicated that motion control move, navigating its 3D camera through a digital environment that incorporated synthetic water and a digital matte painting of the Long Beach coastline. Imageworks retained the blue sky and natural reflectivity from the original

giant aircraft using custom 8:1 gearboxes, each motor powered by a 75-pound cluster of eight batteries, supplying 12 to 15 minutes of propeller power to lift the 350-pound miniature from the water. Operators and camera crew rode alongside the miniature in a motor launch, moving at 20 miles per hour, and captured the momentous takeoff and landing five times.

plate, then used digital geometry to cast aircraft reflections on the water.

"We took off and landed on the water and re-created a moment from the newsreel footage in precisely the same spot that it flew 57 years ago," observed Rob Legato. "The model was only a few feet in front of the camera, but it looked exactly like the image that had been ingrained in everybody's head of what really happened. There is a bizarre emotional charge seeing history re-created through a movie camera. Looking through the lens excludes everything that makes an image look like a movie set, and it creates a very immediate response. It was one of those great movie moments where everyone involved got a big kick out of it."

The Hercules glides over the harbor, viewed from overhead looking down on the ocean with boats below. DNA composited the down-view using a Vistavision aerial plate of the flying miniature shot from a helicopter over Long Beach Harbor. "We added all the CG boats on the water below," observed Darius Fisher. "It was very challenging; but boujou was able to give us a 3D camera move which we used to assemble the shot in After Effects."



Rob Legato lines up a shot for a post-flight celebration sequence set on the Long Beach waterfront. Filmed outdoors at Santa Clarita Studios, the shot incorporated the hanging Hercules plane miniature and other scaled props and set pieces "including a tent, rocks, a bathroom shack, a sea wall, oil drums and crates" built by New Deal. To force the perspective and make the aircraft appear as large as possible, modelmakers scaled down all of the surrounding props and set pieces by 20 percent.

Two shots in the sequence featured a completely digital version of the flying boat generated by Imageworks - one shot tracking back from the cockpit to reveal the entire aircraft with its engines powering up, another featuring a climactic camera move from wide shot into the full-scale cockpit set with actors. "We were originally going to replace just the fuselage using miniature wings and propellers," observed Pete Travers, "but the camera couldn't get close enough to the miniature cockpit and we were building a CG Hercules anyway, so we decided to use the CG model for the whole shot." Imageworks used surveys of the miniature to model proportions of the aircraft, then created surface details using photographic reference and shader work. "The Hercules had a very strange-looking reflective surface, where reflections were sharp closer to the aircraft, then became blurrier further away. That required a lot of very computationally expensive reflection passes, so we relied mostly on shader work to create variations. Then, as we transitioned through the window, we turned off the CG glass to end up on the closeup on Leo's eyes."

The film concludes with a celebration on the Long Beach waterfront in the shadow of the Hercules' giant wing. The sequence featured first-unit photography of the full-scale mockup shot in Montreal, with greenscreen portions completed via a Robert Stromberg matte painting. Wider angles incorporated a hanging miniature, photographed in Santa Clarita using the 1/16-scale miniature with additional scale props. "Rob wanted the Hercules to feel colossal," said Matthew Gratzner, "so we scaled down everything around the aircraft by about 20 percent. We built a 1/19.5-scale tent to match a tent interior built in Canada, a bathroom shack, the seawall and the rocks with little oil drums and crates. We then dressed the plane, the tent, the bathroom and the seawall in the foreground. About 100 yards back from that, Rob positioned actors in costume, with period cars, on a steel deck. When we looked through the lens, it all compressed together."



The forced-perspective post-flight celebration wide shot also featured costumed actors and a variety of period automobiles, which Legato positioned on a steel deck approximately 100 yards back from the scaled set. Viewed through the camera lens, the setup suggested a truly massive Hercules dominating the scene. The final composite incorporated computer generated water, matte-painted elements by Robert Stromberg to fill in background areas, and digital photography of additional cars, all of which enhanced the mostly in-camera effect.



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Robert Stromberg completed the waterfront scene by adding matte-painted elements and digital photography of additional vehicles, enhancing the mostly in-camera effect. "The great thing about shooting a hanging miniature," noted Rob Legato, "is that it is the fastest, most inexpensive and best-looking way to shoot a visual effect, bar none. There is no other method that is that quick, that cheap and that good-looking. I couldn't make it better looking as CG - I'd be lucky if I could make it nearly as good. The oldest technique in the book - shooting the model outside, with all the reflective qualities of environment around it - ended up being the best technique."

The Aviator was Martin Scorsese's heftiest visual effects film to date, containing 408 effects shots. Nevertheless, the visual effects team strove to accommodate the director's independent filmmaking spirit by keeping effects in service to the story. In the last few months of postproduction, the team set up shop in Rob Legato's basement - with four staff members, three laptops, two servers and a render farm of three personal computers providing a cost-effective resource for honing final shots. "The four of us did what you might hire a dozen people to do in a big company," stated Legato, "where you'd have to pay overhead and costs per shot to defray that cost. It ended up being the simplest way to incorporate visual effects into the film without burdening Marty and Thelma with the technical nature of shots. It allowed them to make this big studio-style picture in an independent way, supplanting money with cleverness and ingenuity - and that was exhilarating."

Legato's team converted visual effects shots to high-definition Cinewave Final Cut Pro files, then shipped the tapes to Schoonmaker in New York, who incorporated the shots into her Lightworks digital editing system. Scorsese then critiqued effects in the context of the evolving film and ordered revisions from Legato's basement team. "We were trying to deal with the new realities of visual effects," commented Ron Ames. "The old methodology of shooting a movie, leaving holes where the visual effects fit, then the visual effects unit fills those holes simply wasn't an organic combination. As a producer, you really need to be able to cost-effectively make changes and be flexible in the vision. That was the most exciting part of the process. Using combinations of work that we were doing and the work that Sony was doing with computing power that we didn't have in Rob's basement, we were able to be very flexible and effective."

The malleability gave Martin Scorsese the option to tweak effects through the final processing of the digital intermediate. "It was a little extra work," admitted Legato, "but it was fun because there was something great about handcrafting a shot, about being so intimate with the material. The business side of the effects industry is sometimes the antithesis of being creative - where if you don't meet a certain deadline, a shot will cost you another \$10,000. Of course,

it's impossible to work in total chaos; but if the work suffers because of the deadline, the tail is wagging the dog. The creative work should tell you how to set up your production pipeline, not the other way around. And part of creativity is getting your hands dirty. Sometimes you really need to sit down with a composite and move images around to know what all the problems and the opportunities are. If you don't do that, you exclude yourself from the possibility of that moment of inspiration."

The film's palette of effects was ultimately characterized by a blend of contemporary and old school filmmaking techniques, fueled by the filmmakers' fascination for the history of cinematic illusions. "I was always fascinated by effects techniques used back in the forties," concluded Legato. "People had to be very clever back then because they did not have the computer technology that we have today, and they didn't have the benefit of the knowledge we take for granted. There was no voodoo to it; it was hardcore cleverness. They shot everything in-camera because there was no other way of doing it. They didn't have optical printers when they first invented this technique, so somebody really bright came up with the idea of the hanging miniature, which took advantage of an optical property of two dimensions - and it works like you wouldn't believe! If you don't have an appreciation for that sort of technology, if you act like 'that's old fashioned,' you throw the baby out with the bathwater, and it can end up costing you ten times as much to create a shot digitally. All it requires is a little photographic knowledge of how to set up a shot, and a little bit of discipline."

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ACME EFFECTS

ARTICLE BY JOE FORDHAM

In a career that spanned 60 years, the wit and charm of animator Chuck Jones graced more than 300 animated films, and earned him three Oscars and a Lifetime Achievement Award from the Academy of Motion Picture Arts and Sciences. Joining animation directors Tex Avery, Bob Clampett and Friz Freleng at Warner Brothers in 1936, Jones imbued life to many of modern popular culture's most enduring animated icons – including the urbane, carrot-chomping Bugs Bunny and the spluttery, irascible Daffy Duck. Jones' own creations included the inexhaustible Road Runner, the eternally ravenous and inventive Wile E. Coyote, and a high-stepping amphibian with a top hat, cane and golden singing voice – Michigan J. Frog.

image

The cartoon legacy inspired generations of artists, including comic book creator Mike Richardson whose Dark Horse Comics publication, *The Mask*, found its way to movie screens in July 1994. Directed by Chuck Russell, the film capitalized on the comedic contortions of rising star Jim Carrey clad in a prosthetic makeup by Greg Cannom, enhanced with 3D digital animation created by Industrial Light & Magic animators channeling Tex Avery.

Ten and a half years later, New Line Cinema unleashed *Son of the Mask*, featuring a new star, a cavalcade of visual effects and a new director, Lawrence Guterman, whose credentials included training in animation and an effects-filled debut feature, *Cats and Dogs*. "The studio spent a lot of time coming up with different takes for a sequel," related Guterman, "but it wasn't until late 2001, when screenwriter Lance Khazei took it out of the realm of another person simply getting the Mask, gaining confidence and getting the girl, that they sparked to the idea. Jim Carrey had been so explosive in the first film the thought was, 'How are we going to replace what he did with another actor?' Lance's script took it into the realm of an ensemble picture, so the entertainment value was spread across a number of performances."

Son of the Mask's storyline involves fledgling cartoonist Tim Avery (Jamie Kennedy), who uses the Mask as a Halloween costume and, transformed by its effects, fathers a son with wife Tonya (Traylor Howard). Nine months later, the family's Jack Russell terrier senses all is not right with the infant and utilizes the Mask to wage war with the child. Meanwhile, the original owner of the Mask – Loki, Viking god of mischief (Alan Cumming) – attempts to retrieve the Mask to placate his father, Odin, and the movie delves further into themes of paternal responsibilities, canine and infant possession, and cartoons run amuck.

Echoes of Looney Tunes resonated throughout the production. "Larry wanted to get into the head of both the father, who was an animator who loves classic cartoons, and the kid who is learning to see the world through cartoons," observed visual effects supervisor and second unit director Jamie Price. "The reactions of the characters, the staging of scenes, the color palette

all reflected the cartoon aesthetic. When I came on board, Larry and visual effects producer Susan MacLeod had gone through the script a number of times and built a library of classic Warner Brothers cartoons that the writers had referred to. One of the centerpieces in the film was One Froggy Evening, Chuck Jones' famous cartoon where a frog dances for a guy that finds him, but won't dance for anybody else. This became the cartoon that pushed the baby over the edge in his transformation."

One Froggy Evening was the inspiration for a second-act scene in which Avery attempts to convince other characters of his son's strange abilities. The cartoon's deadpan frog also inspired a new approach to animated performance, a marked contrast to the zany antics of Jim Carrey. "In the first Mask, the influence had been largely 1930s and 1940s Bob Clampett and Tex Avery," said Larry Guterman. "But Lance Khazei and I grew up on 1950s cartoons, when animators like Chuck Jones, Ken Harris and Abe Levitow refined those comic timings."

The production consulted writers from the animated television series The Simpsons and other contemporaries in the cartoon field to brainstorm Tim Avery's cartoon output and the design of the animation studio in the film. The main location for the story – and the arena for much of the animated character antics – was the Avery home, constructed on soundstages at Fox Studios Australia, in Sydney, as a two-story set complete with backyard, trees and cyclorama backing. For establishing shots, production designer Leslie Dilley erected a full-scale façade of the house and a neighbor's house in the Sydney suburb of Burwood. "I wanted an all-American cartoon Craftsman style house," stated Guterman. "The rest of the street was not like that, so we built Tim's house on a lawn tennis court, gave the proportions a bit of a tweak and widened the thicknesses of the beams like a cartoon."

Guterman storyboarded the film extensively with art department illustrators and enlisted Pixel Liberation Front to develop 3D animatics to guide scenes involving animated characters, which became the principal focus for visual effects.

To represent the movie's title character, Alvey Avery, Guterman selected a pair of eight-month-old twins, Ryan and Liam Falconer, as an interchangeable acting tag team. Animal coordinator Scott Berens trained and supervised a canine performer named "Bear" to play Otis, the family dog. But the plan from the outset was to use visual effects for characters' interacting and performing in Mask-like manner, revealing their cartoony inner id. The production assigned Alvey scenes to ILM and Otis scenes to Tippett Studio, while special effects supervisor Brian Cox created on-set interactions and Keith Vanderlaan's Captive Audience Productions – prosthetic and animatronic veterans of the first Mask film, by association with Greg Cannom – investigated characters' physical manifestations.



In a sequel to the 1994 comedy, *The Mask*, cartoonist Tim Avery (Jamie Kennedy) discovers the joys of parenting when his baby son, Alvey (Ryan and Liam Falconer), exhibits cartoon-character abilities as the title star of *Son of the Mask*. Taking inspiration from the animation of Chuck Jones, director Lawrence Guterman and visual effects supervisor Jamie Price called on Industrial Light & Magic to provide digital incarnations of Alvey, intermingling physical effects supervised by Brian Cox, makeup effects and animatronics by Captive Audience Productions, a family pet animated by Tippet Studio and effects from nearly a dozen other digital vendors.



ILM visual effects supervisor Ed Hirsh and animation supervisor Tom Bertino joined the main unit in Sydney, Australia, to block out shots of Alvey exhibiting extreme cartoon-like behaviors. Bertino occasionally stepped into frame to demonstrate the wild infant actions, rehearsing

ILM visual effects supervisor Ed Harris and animation supervisor Tom Bertino joined the main unit in Sydney, Australia, to block out shots of the child performers taken with an array of cameras. Alvey exhibiting extreme cartoon-like behaviors. Bertino occasionally stepped into frame to textures, from which digital artists derived demonstrate the wild infant actions, reinforcing reference for Viewpaint and texturing schemes on the 3D model. Back at ILM, digital artists generated a 3D baby model using photographic studies of the child performers taken with an array of cameras. The array also captured diffuse photographic textures, from which digital artists derived reference for Viewpaint and texturing schemes on the 3D model.



A short animated sequence " cut from the domestic release " reveals the genesis of the infant Alvey's unusual powers, as three Mask-faced sperm race to fertilize a human egg. Kleiser-Walczak played up the comedic aspects of mitosis, keyframe-animating the hero sperm with Looney Tunes-style expressions. Subcontractor Post Amazers generated clouds of background sperm by applying procedural swim cycles. Kleiser-Walczak created the waiting egg using a multilayered, translucent RenderMan shader and a hint of green at the moment of creation.



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"It wasn't clear when we first met with Larry to what degree he wanted to use animatronics," noted Keith Vanderlaan, founder of Captive Audience. "What was clear was there were a significant number of shots that needed solutions, and they didn't want to assign a visual effect for every solution. So we decided to create a number of mechanical babies, or baby parts, to try as many practical solutions as possible, knowing we could then fall back on visual effects for things that a practical baby puppet could not do. It was wonderful to work on because it combined the talents of both schools of thought."

Eight weeks in advance of shooting, Captive Audience artists measured and photographed the Falconer children, calculated the children's rate of growth to estimate the appropriate size of animatronic pieces, and built Alvey puppets in six variations – standing, crawling, walking, a closeup hero version for three-quarter back views, a stunt "pick-up-and-run" baby and a nonmechanized 'stuffy' version for lighting. All puppets were fitted with silicone skins, detailed with hand-punched human hair, and contained weighted, jointed armatures sprung to portray realistic infant floppiness. "Even the stunt version had arm movement and head floppiness," stated special makeup and animatronic effects supervisor Brian Sipe, "and all of them were heavy. If you tell an actor, 'Act like it's heavy,' half the time they'll forget, so we made them a little heavier than a normal baby." The puppets were actuated with self-contained radio controlled mechanisms, allowing puppeteers to operate from off-camera with no trailing wires or cables. The standing puppet was used most often, either secured through the set or fastened to a C-stand plate, and could be configured in a seated mode displaying upper body and arm movement.

The production used baby puppets or a lighting double to conserve the Falconer children's time on set, as allotted by child labor laws, and worked with visual effects to maximize performance. "The twins could only be on set for six hours a day," recalled ILM visual effects supervisor Ed Hirsh, "and they could only be in front of the camera for a couple of hours a day, so there was a lot of concern about how much work we could get done with the real kids. Conceptually, we were always considering, 'Can we use a puppet for long shots?'"

While the puppets proved highly effective for non-ambulatory wide shots, high angles and scenes of Alvey carried through frame, the first day of working with the babies established ground rules for infant performance. "We realized it helped to get as many people out of the set as possible," remarked Ed Hirsh, "so we positioned the camera monitor around the corner from

them and cleared their field of vision. That became a problem because a couple of times Larry wanted to shoot wide-angle closeups and immediately the kids would look at the lens, or would reach out to touch it. So it was always a struggle to maintain their eyelines, yet have the camera close enough to them and not distract them.” The twins’ father served as their on-set acting coach, sometimes visible in frame. In those situations, ILM removed the father through split-screen tricks, and used similar 2D tricks to integrate child performers into loud or complex scenes where Alvey was supposed to remain an amused and jolly observer.

For more complex scenes with Alvey, ILM digitally manipulated live baby images. “The baby became a different character when he was messing with his dad,” noted Jamie Price. “Larry wanted him to move with great control, eventually doing very extreme, un-baby-like motions. That presented a major challenge in making the baby look realistic, because he didn’t have the characteristic wobble or uncertainty that a real baby had, and he would snap from one persona to another. To help those transitions, we often used 2D techniques to control Alvey’s expressions and direct his ‘acting’ – so, by the time the baby became this wacky character possessed by the Mask, the audience was set up for it.”

ILM Sabre artist Sam Edwards enhanced live baby images using a rounded mesh of geometry matchmoved to the natural motion of the baby’s head. ILM animation supervisor Tom Bertino then guided the cartoon-influenced performance. “So much of Chuck Jones’ style is communicated by a character simply raising an eyebrow in a certain way,” noted Bertino. “It creates a certain dry expression that can crack you up. Larry was very interested in exploring that style of acting; and so, when we were designing shots where the baby pulled facial expressions to express disdain or amazement, I sketched preliminary models of faces to guide manipulation of the 2D image. We mostly concentrated on the baby’s brow and the corners of his mouth. The big trick was when he spoke a line of dialogue and we had to open his mouth. We did that by cloning mouth interiors from other pieces of footage, taking the teeth and tongue and matchmoving them to where we needed them to be.”

When Alvey’s performance became more extreme, ILM employed a fully animated 3D character that further played into Guterman’s exploration of cartoon style. “In our first meeting with Larry,” recalled Bertino, “as soon as he mentioned this was Chuck Jones, not Tex Avery, I knew exactly where he wanted to go. We were having lunch, and I started sketching poses on a restaurant placemat, drawing really wild takes that this baby might do. Larry kept that placemat on his office wall throughout production; and whenever a question arose about a pose or an expression, he’d refer back to those drawings.” Bertino collected additional facial expressions and attitudes from his personal library of cartoons, sampling Jones’ gallery of characters. “Whether it was a baby or a kitten, Chuck Jones always favored the cute or innocent character doing mischievous things more or less unknowingly. We found a wealth of material that helped us take the baby idea and stretch it out to the type of character Larry wanted.”

The 3D baby also drew heavily on ILM's research in digital humans, which was in parallel development for the animated baby in Lemony Snicket's *A Series of Unfortunate Events*. "There were many stylistic differences between Lemony and Mask, both in terms of animation and look," said rendering development and lead engineer Christophe Hery. "On the rendering side, the technology was similar, but we were able to make it more stylized on Mask." As with Snicket, 3D baby modeling involved photographic studies of the child performer and reference scans at ILM. "Colin Davidson, Francesco Callari, Sean Casey and I devised a system that used an array of cameras, triangulated between them and derived a 3D mesh, which we used as a template for modeling."

To texture the CG baby, ILM synchronized its camera array to extract simultaneous photographic textures of the baby performer, from which they then derived color information. "We put polarizing filters on the lights and cross-polarizing filters on the camera lenses," Hery said. "That helped remove reflections. We also created albedo maps with pure diffused colors, which allowed us to calibrate lighting setups and extract reference for Viewpaint and texturing." To light the model, CG supervisors Robert Marinic and Tom Martinek utilized reference plates of each live-action camera setup, derived from a Panoscan 360-degree high dynamic range digital camera, and adapted Snicket global illumination technology to fit the Mask palette. "On Lemony, we lit our baby model by bouncing light off 3D models of the environment. On Son of the Mask, we used the environment directly as an environment map, taking artistic license with what was in the plate. This was a little faster in computation - we didn't have to intersect pieces of furniture in our lighting model - and it fit with the more cartoony look we needed for this film."

The final CG baby used a highly detailed lighting model that simulated radiosity, ambient occlusion, reflections, subsurface scattering and 'peach fuzz' on the baby's skin. Although complex, the resulting texture map allowed for highly malleable lighting scenarios that could be adjusted to accommodate Alvey's bizarre contortions. "When the baby went into an extreme cartoon deformation," commented Hery, "we morphed him into a plastic look. It was a stylistic decision, because when Alvey transformed into Woody Woodpecker or other cartoon characters, they



Tim Avery's anxiety about becoming a father is illustrated in a fanciful daydream scene in which the young man envisions his wife in labor, producing offspring with machine-gun rapidity. For a shot of the imaginary brood thrust into their father's view at the maternity room window, Jamie Price filmed multiple takes of nurse performers clutching babies in their arms. Digital Dimension assembled the elements in a wide-angle, cartoon-styled composite, and tracked 3D needle-like fangs to each howling infant maw.



didn't want him to look translucent. There were a few exceptions where we introduced full global illumination and subsurface scattering to his extending limbs, but that was not a problem. Subsurface scattering relies on a semi-uniform distribution of points to represent the effects of light scattering inside an object. We computed our in-between passes at 1K before we went to 2K or 3K, and interpolated the data in RenderMan."

Animating Alvey's extreme deformations required custom modeling and rigging, animating and morphing between a series of sculpted poses, tempered by an acute awareness of the grotesque. "A round, soft, pink, adorable, newborn baby is something that everybody knows very intimately," observed Tom Bertino. "If that baby goes completely berzerk, sticks out its tongue and bugs its eyes, or if its head flies up on a spring, you have to be very careful; because if you take it too far, it can become very unsettling. There is a place on the curve where 'realistic' becomes horrifying before it comes around to entertaining." Bertino's team discovered that the speed of Alvey's cartoon transformations was key to translating 2D cartoon effects into the 3D realm. "By going straight into the most extreme cartoony pose, it took us straight into another realm, and our audience was with us. If we dialed that back, however, or tried to be too subtle, the transformations became unsettling. So we went full, flat-out cartoon."

The 3D baby was also required to express photorealistic infant behavior that dovetailed seamlessly into photography of the Falconer twins. ILM built a library of animation reference for those scenes, filming motion and expression studies with the young performers, and conducting extensive motion capture with children and adults in postproduction. "We had adults step in as children because the flow of the performance for specific actions was so specific you could never direct a toddler through the scenes," Bertino explained. "That was extremely useful - but it was interesting to take an adult's anatomy and translate those proportions to a child. Motions looked more exaggerated when an adult was performing, and it added a level of humor that we probably would not have considered if we had been animating entirely with keyframes."

Concurrent with baby Alvey's development at ILM, the infant's canine rival, Otis, was taking shape across the San Francisco Bay at Tippett Studio. The possessed pooch was derived from similarly lengthy research and development that included sculpts by conceptual artist Tom Hester, and twenty clay maquettes by Tippett Studio character designer Damon Bard. "Otis was a deluded, crazy character," stated Larry Guterman. "The idea was he may have felt like he was a diabolical mad scientist, but these were really delusions of grandeur, somewhat like Wile E. Coyote. We strove to reflect Coyote and Bugs Bunny brow positions, in terms of their deadpan performance and range of expressiveness. It wasn't 'Disney sweet'; but it wasn't Ren and Stimpy or SpongeBob, either. It was more like the Grinch that Chuck Jones drew in 1966."

The creator of the Mask " an ancient Viking relic that releases the wearer's inner cartoon id " is introduced in the opening of the film when Loki (Alan Cumming), Norse god of mischief, manifests himself before a group of startled museum visitors. Captive Audience realized Loki's Mask face, and several other Loki manifestations in the movie, through a variety of facial prosthetics. Appliances were cast in a custom silicone formula, impregnated with green pigment, overlapped in multiple pieces and painted with standard makeup materials. Prosthetic makeup artist David Dupuis applies final airbrush details to Cumming's Loki Mask face.

To assist live-action photography of Otis scenes, Captive Audience constructed a series of puppet dogs that featured radio controlled articulation and realistic fur. "Otis went through so many different design phases, the look wasn't finalized for shooting," said Keith Vanderlaan, "so we kept designing and redesigning until we had something that looked both sympathetic and menacing, yet still fit within the cartoon element of the film." Brian Sipe's team built four Otis puppets: a 'stuffy' version for lighting reference on set, a stunt version, a burnt version and a mechanized version. The mechanical Otis had expressive ears, jaw, lip, nose and brow movement, drool, a flopping tongue, and eye-blink with a cartoon surprise function allowing its eyeballs to lunge forward.

The Otis puppet was ultimately seen in only a few shots in the film, the creature's final look determined by the performance of Tippett Studio's CG character. "Larry was always very particular that we had to know when to go big with the animation and when to hold back," stated Tippett Studio visual effects supervisor Thomas Schelesny. "On a show like this one, which lent itself to very large cartoon moves, Larry wanted a contrast to the parts of sequences that had more action. So he urged us to calm the character down, even freeze him for a moment as he did a comic take, with obvious parallels to Wile E. Coyote holding completely still with only his pupils looking to camera."

Photography of CG Otis scenes began by orchestrating timings of background plates. "Jamie and I first looked at the realities of shooting on the stage," said Schelesny. "If we couldn't match the previz camera moves, we sometimes undercranked the camera. We then timed the animation on the stage to get the camera crew accustomed to the speed we wanted to move and where they should be holding focus."

A wire capped by a ping-pong ball often represented Otis' position on set, while the stuffy dog served as lighting reference along with HDRI reference shot by Tippett Studio plate supervisor



Loki's father, Odin, chief deity of the Norse pantheon, appears to his son as a disembodied face in the clouds. Actor Bob Hoskins portrayed the character wearing a seven-piece Captive Audience prosthetic age makeup. Tippett Studio composited Hoskins with animated light rays and cartoon-colored volumetric clouds rendered in Maya.



Captive Audience also manufactured a surreal giant nose prosthetic, seen later in the film when a nosy neighbor (Magda Szubanski) interrupts Loki in his pursuit of the Mask offspring. The latex-cast nose was articulated with nostril twitch.

Eric Marco. "We would block the shot to get an idea of how close the dog should be to the lens, and we would rehearse with the hand puppet very slowly, then remove the puppet, start moving the camera faster and faster, with either Jamie or myself calling out timings. There's a technical side to getting timings right; there is also a creative angle, in terms of finding the spontaneity of doing it in real time, so I often vocalized what the dog was doing and performed the dog's 'voice' at the same time."

The camera crew took cues from Schelesny's often manic vocalizations from behind the camera. Back at Tippett Studio, Schelesny stepped in front of a video camera and, with animation supervisor Dovi Anderson and lead animator Jim Brown, revealed his canine inner self. "We shot miles of video where I made faces," said Schelesny, "trying to come up with appropriate expressions for the dog. Dovi and Jim coached me into different types of moves and we built a menu of animation reference, which we put online. We have hours of embarrassing video that may come back to haunt me on DVD; but it gave the animators the confidence to stand up and perform next to their desks, knowing their peers understood what they were doing. Telling an animator 'Make it funny' is meaningless; but saying, 'No, no, make it like this: bl-lu-lu-lu-leaaaargh!' gives you the courage not to be embarrassed expressing that performance. It enabled us all to be on the same page."



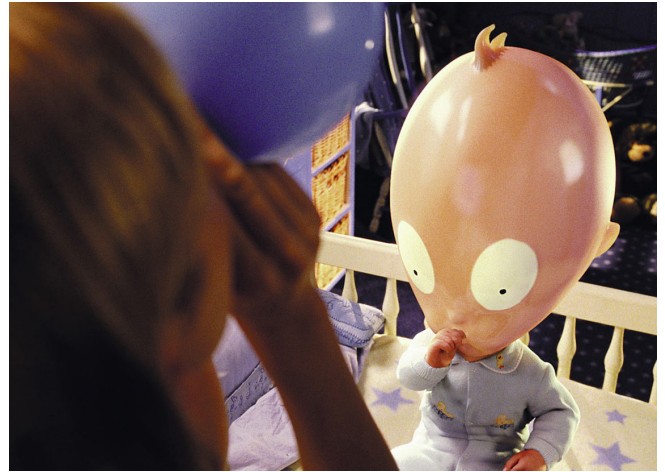
Tonya Avery (Traylor Howard) entertains her son by blowing up balloons, failing to notice Alvey's explorations of his own inflation capabilities. To initiate animated transformations, ILM generated a photorealistic digital likeness of the child performer designed to seamlessly cut to and from live photography of the Falconer twins. Expression studies with the young performers and extensive motion capture fed into the keyframe animation. An intricate lighting model simulated the natural glow and translucency of a baby's skin.

Photographic studies and measurements of Steve Beren's Jack Russell terrier also served to ground the 'dogginess' of Otis prior to his transformation. Bear went through his paces – standing, sitting, walking, jumping up – and posed for closeups with a camera lens a quarter-inch from his face. The reference material and character maquettes fed into construction of Tippett Studio's 3D animated Otis, which employed a new approach to the company's facial animation pipeline. "Our lead character setup person, Eric Jeffery, and character setup artist David Richard Nelson challenged me to think of the facial rig in a different way," remarked Schelesny. "Traditionally, we would take each pose as far as possible with animation, then build a blend-shape and morph into that shape.

But in doing that, the animator loses a lot of localized control. Eric and David wanted to accomplish the facial poses in a way that would allow the animators the most control."

The new pipeline involved constructing hundreds of animation controls, allowing animators to sculpt the building blocks of a performance, then program key facial shapes. Otis' facial animation incorporated 18 key poses, approved by the director and then saved into a library. "Any animator could click on a button that said 'Smile' and the dog would smile," related Schelesny. "It would be a very generic and non-shot-specific smile, where both sides of the face were symmetrical, but it was a starting point. The animator could then take that starting point and push it to the extreme, or play the expression towards camera and still be able to control the outside edge of the dog's eyebrow or the edges of his lips. We didn't rely as heavily on the modeling department to build faces for us; we relied much more heavily on the animation department, which allowed us to modify our models and keep it in the animation pipeline."

Otis was built with subdivision surfaces to accommodate detail and increase mesh resolution. Shaders attributed roughness and displacement to the nose and facial details, scalable in proportion to the character's proximity to camera. Lead CG painter Raine Reen furred the digital dog using Tippett Studio's in-house fur shader. "Our fur tool is quite extensive," CG supervisor Todd Stinson stated. "We used a bunch of guide splines, which control effects animation passes. On top of those, we also had more than 200 paintable attributes to model and sculpt fur length, scraggle, waviness, twist and parting. Then, on top of that, we had another 80 attributes to color the fur. Otis was a



For extreme deformations, the 3D baby morphed rapidly through transitional models, rendered with a plastic sheen to capture the character's toony nature.



Alvey reacts with alarm as his sleep-deprived father mistakenly offers him a broken table lamp in place of a baby bottle. The speed of Alvey's cartoon reactions proved a crucial factor in translating the style of classic 2D animation poses into the 3D realm. When early tests proved that slower transformations took the character through realms of the grotesque, animators limited

pretty specular dog. He was almost frosty at times, with a green base coloration.”

transitions to snap between poses in three or four frames “ six at the most ” emulating the meticulous comedic timings of the vintage Looney Tunes cartoons.

Before battle commences between dog and baby in the Avery household, the movie opens with a series of effects that included contributions from Tippett Studio, ILM and close to a dozen visual effects vendors. Tippett Studio’s work included a number of digital matte paintings composited by Charles Granich for the opening scene that reveals the apparent resting place of the Mask inside the Edge City art museum. The camera tilts down from a digital sky, with 3D lightning bolts and rain, revealing the city – a digital matte painting featuring 3D geometry rendered with numerous reflection passes created by matte painter Kent Matheson – blending into a photographic element of the museum. The camera booms up over the museum and matchmoves to a 3D extension of the museum roof, before descending through a skylight into a live-action plate filmed inside Sydney’s City Hall.

Inside the museum, Loki is introduced as the mischievous deity infiltrates the mortal realm using a shapeshifter capability. Captive Audience sculptor Glenn Hanz sculpted Loki’s Mask makeup, revealed as the character’s dark side emerges. Tippett Studio animated a Loki Mask reveal in the art museum by adding volumetric storm cloud effects to a swirling 360-degree shot of Alan Cumming in human guise, then matchmoving to a locked-off plate of the actor in makeup. Digital Dimension handled a subsequent two-part morph effect, stabilizing takes of Cumming delivering a line, with and without makeup, rotoscoping the actor from the background plate, then painting out and animating dark makeup lines to grow back into place across the performer’s face.

Mask-donning effects appear later in the movie when Tim Avery, seated in his car, applies the Viking relic to his face as the final part of his Halloween costume. Giant Killer Robotsc created Mask-donning transitions based partly on ILM’s effects in the first film. “ILM had animated fingers that grew over Jim Carrey’s head,” commented Mike Schmitt, visual effects supervisor at GKR. “The Mask in that film seemed more like undulating clay. As we worked on ours, Larry Guterman added a few ideas that made it look more like the face-hugger in Alien. It was scarier, grabbing very quickly with sharp, ugly-looking fingers that grew out as Tim thrashed around.” Jamie Kennedy mimed the action on set; Giant Killer Robots tracked the actor’s motion using 2d3 boujou; then animator Bill Haller animated the Mask to the plate. The final Mask effect also featured a ‘green miasma’ glow of light traveling through the Mask and shining out through cracks.



Alvey attempts to leaven his father’s spirits by leaping out of his baby chair and performing a high-stepping number inspired by the Chuck Jones animated classic, One Froggy Evening, about a

Tim steps out of his car with a hyper-extending animated limb, created by ILM, and his face contorts into the familiar toothy grin and lime-green sculpted visage – one of several prosthetic Mask makeups created by Captive Audience. “We wanted to use the essence of the Jim Carrey/Greg Cannom makeup but also create a new look,” stated Brian Sipe. “The previous makeup was a little edgier and very sexual, because that movie was based on the Tex Avery style. This one was a little more Chuck Jones, so we softened it up and made it a little more kid-friendly.”

Whereas the Carrey Mask face had been created in foam latex, Captive Audience generated sequel makeups using a custom silicone formula – recipient of a recent Academy ‘Sci-Tech’ award. “The processes for generating silicone prosthetics have always been very complicated and expensive,” Keith Vanderlaan noted. “We started developing silicone products in 1995, and learned what not to do. Brian Sipe brought in Wes Wofford, and they examined how and why silicone came together; then Greg Cannom introduced a component that changed the dynamic of the product completely in the way it accepted light, refracted light, its translucency and movement. More importantly, the product can be painted using regular makeup, and we have used it very successfully for overlapping appliances, blending edges in the middle of a face. All the problems that people normally have with silicone, we don’t have with this product.”

Captive Audience generated Avery’s Mask face as a nine-piece facial prosthetic, sculpted by David Smith, with a sculpted foam latex hairpiece. Sipe and prosthetic makeup artist David Dupuis applied the makeup in Australia. Facial appliances were tinted with a lime green pigment selected from the Pantone color chart by Larry Guterman. Sipe and Dupuis then airbrushed detail onto the makeup and fitted Kennedy with oversize acrylic dentures created by Chris Gallaher. Total application time was approximately two and a half hours.

Makeup effects were also featured in scenes involving Odin, who becomes aware of trouble brewing with the Mask. Bob Hoskins portrayed the deity wearing a seven-piece Captive Audience prosthetic age makeup, with wispy locks of hair generated as hand-tied lace-backed appliances. Les Dilley created Odin’s throne of Asgard and immediate surroundings, assisted by smoke effects from Brian Cox’s floor effects team. Tippett Studio then created wide shots of a crumbling island of rock floating in space, using a digital model composited by Colin Epstein, which combined digital elements with practical smoke and cloud elements and digital volumetric clouds.

dancing frog. The scene was one of the most difficult to animate, requiring the 3D animated baby to perform physically impossible moves while capturing the spirit of Jones’ Michigan J. Frog animated classic, One Froggy Evening, about a dancing frog. The scene was one of the most difficult to animate, requiring the 3D animated baby to perform physically impossible moves while capturing the spirit of Jones’ Michigan J. Frog. Sessions with an adult dancer emulating the cartoon frog on the ILM motion capture stage provided a starting point for motion studies, but the scene was achieved primarily with keyframing executed by a team of seven animators.



While the production coaxed a range of expressions from the child performers, ILM enhanced some of Alvey’s more introverted moments and vocal utterances using subtle digital

Loki's quest to find the Avery child involves a series of shapeshifter disguises, the first of which transmutes Alan Cumming's character into a cartoony bumblebee searching a maternity ward – a digital character generated by Tippett Studio.

manipulation. Sabre artist Sam Edwards created expressions using a rounded mesh of geometry matchmoved to the natural motion of the baby's head. For vocalizations, the ILM team cloned portions of the child's face, sampling glimpses of teeth and tongue, then matchmoved and manipulated the footage to simulate speech.

"We took cyberscan data of Alan Cumming," related Thomas Schelesny, "built a CG nose and incorporated that into the character of the Loki bee, with a little mole between his eyebrows like Alan's, bright yellow eyes, antennae, wings, little cartoon gloved hands and cartoon feet." CG painter Tim Odell textured the bee with a black furry mane and introduced a Mask-green tinge with shimmering specular components in place of yellow stripes. Composited into tracking shots along a hospital corridor, the tiny character appeared to buzz angrily at passersby until it rested on a macro-closeup of a nurse's ear, before taking her form.

Subsequent Loki transformations involved prosthetic effects, created by Captive Audience, occasionally in collaboration with key makeup and hair designer Viv Mephram. "Loki had a lot of different looks," related Brian Sipe. "He had his regular look – with Alan looking pretty with his hair up – his Mask face, 'Lightning-strike Loki' for when he gets electrocuted and another for when he gets a gunshot in his face very much in the style of Chuck Jones. Alan did a great job with Loki as a plumber. We put a bald pate on him, a lace wig, mustache and dental prosthetics to give him a jolly look. We also gave him a semi-fat-suit with a big silicone plumber's butt-crack as the highlight of the application."

The object of Loki's quest is foreshadowed in a 3D-animated sequence – produced by Kleiser-Walczak – in which, following a night of Mask-enhanced passion on the part of his father, the infant Alvey's genesis is depicted in utero. "It's amazing when you have a sperm sequence in your movie how comfortable you become with the word 'sperm,'" said Jamie Price.

"Unfortunately, the sequence pushed us to a 'PG-13' rating; so we omitted it from the domestic release, and it will only be seen in foreign versions. But it's the first inkling that something wacky is afoot after Tim and Tonya go to bed."

Kleiser-Walczak art director Diana Walczak supervised sperm sequence design, which featured a colorful, undulating environment representing a fallopian tube and the three enthusiastic cartoon spermatozoa. "We named them after The Three Stooges," remarked visual effects supervisor Jeff Kleiser. "Larry was on the left, Moe in the middle, and Curly on the right." Derald Hunt animated the three to argue, then break for their objective – to the tune of the theme from Chariots of Fire – amid clouds of background sperm animated with procedural swim cycles by Karachi subcontractor Post Amazers. CG supervisor Erik Paynter's lighting team employed a multilayered, translucent RenderMan shader to generate a stylized waiting egg, then created layers of visual effects that erupt in a blaze of light upon mitosis.

One unusual pregnancy later, baby Alvey reveals his cartoon identity when his father exposes him to a Chuck Jones classic on TV and the toddler lets rip with a razzmatazz rendition of Michigan J. Frog's vaudeville ballad "Hello, My Baby" from One Froggy Evening. The sequence was one of the most demanding for the ILM animation team, pushing the limits of the CG baby's credibility and defining the look of the character's most extreme poses. "Get out your thesaurus and find how many euphemisms you have for the word 'pain,'" quipped Tom Bertino. "It was very tough. This was where we found out that a performance we'd bought for years as a 2D animation didn't have the same effect in a 3D world. It was not as simple as redoing the existing animation in 3D. We had to do all sorts of compromising and compensating to make those original poses work in 3D. To make a nice, fleshy baby dance like a 2D-animated frog, we had to collapse him, break him, twist him – it was very painful for the character and it was a very delicate situation for us to capture the essence of the drawn animation."

ILM shot background plates for the dance as wild camera moves assisted by playback of the song, along with the full gamut of previz, dummy babies, eyeline markers and Tom Bertino's spirited vocal animation cues. Brian Cox's team triggered air rams to topple furniture, and used light-emitting diodes rigged via a sequential firing box to detonate small pyrotechnic charges to cut wires and release bungee springs for more intricate interactive physical effects.

To further ground the sequence in a semblance of physics, ILM later orchestrated a Froggy Evening dance session on its motion capture stage. "We motion captured some wonderful maneuvers," commented Bertino, "but the first time I had our dancer in front of the camera, I said, 'Okay, here's what you have to do.' I ran the cartoon of One Froggy Evening, and the first words out of the dancer's mouth were: 'Well, you realize that can't be done. You can't lean back that far, you can't have your leg up that straight at the same time and still remain upright.' We got as close as we could, and he did an amazing job; but in the end we used motion capture as a hanger on which to drape a lot of keyframe animation. Larry wanted it so much like Michigan J. Frog, and that was something that human anatomy would not support in approximately 98 percent of the cases. My lead animator, Scott Wirtz, pretty much defined the initial look of that performance; but we spread the wealth because there were so many shots. We had about seven different animators working on that sequence."



Otis, the family dog supplanted by the new baby, dons the Mask, and endeavors to reassert his position in the family hierarchy. Early Otis scenes featured a Jack Russell terrier trained by animal coordinator Steve Berens. Captive Audience supplied a number of puppets to assist with initial stages of Otis transformations. Tippett Studio generated Otis' fully altered Mask appearance as a digital creation, the look of which was first developed in clay maquettes. Tippett Studio modeled the CG canine in subdivision surfaces, furred with an in-house fur shader. The manic dog was keyframe-animated via a complex facial rig that allowed animators to sculpt the performance.

Threatened by Alvey's cartoon persona, Otis unearths the Mask and investigates his own enhanced capabilities, intent on reasserting his place in the Avery home. Tippett Studio created digital effects of the Mask leaping onto the dog performer's face using a digital canine, and then pinballed the creature around the yard, accompanied by green miasma effects, and rocketed him skyward inside his doghouse. The backyard set extended to the top of the tree line. Tippett Studio created the night sky as a digital matte painting rendered on a dome with layers of painted clouds and a passing airplane composited by Zoe Peck. "A lot of that scene came together in the composite," noted lead compositor Alan Boucek. "We enhanced the lighting, added a number of elements to speed it up, and made the camera swing up really fast in order to look funny. We used an optical flow tool called Twixtor that predicts where in-between frames should go and tries to maintain motion blur. It creates some warping and distortion, but that was part of the process that we used a lot on this show."

The Mask-enhanced Otis concocts a plan to remove Alvey from his crib using a series of devices seen in one of the film's most elaborate set-pieces, the 'Rube Goldberg' sequence - named after the Pulitzer Prize-winning cartoonist's drawings of absurdly complex inventions. Larry Guterman worked with former Disney artist Kevin Harkey to generate 120 pages of storyboards for the sequence, which was then prevized by PLF and shot over four weeks with Jamie Price directing a second-unit cavalcade of interactive physical effects. "The dog runs a cable through the house, through all sorts of obstructions, that hooks up to a tow truck with a winch," related Brian Cox. "He puts a hook on the baby; then, without his knowing, the baby hooks it back on the dog, and the dog gets dragged through tables that collapse. Fruit on the table flies into the air, he goes through a piano, the piano flies up the stairs and



Tim Avery is oblivious to Otis' transformation until he sees the dog tiptoe past a doorway toting an array of strange mechanical devices. The scene begins one of the film's most elaborate action sequences, in which Otis attempts to oust baby Alvey from the house using a Rube Goldberg system of contraptions. Recalling the failed gimmickry of Chuck Jones' Wile E. Coyote, Otis' contraptions backfire, laying waste to the Avery family home.



Tippett Studio created a range of Otis 'states' to depict the perennially ill-fated dog, including a post-explosion 'Charred Otis,' which modified the 3D model with charcoal textures capable of crumbling and flaking.

all the banisters go flying.” Physical effects included a pre-scored Otis-shaped breakaway door motivated with hidden wires, a mechanized 130-pound piano rigged to fly on an overhead wire rig track, exploding hollow balsa banisters, and a Statue of Liberty made of fruit. “We ran wires through the fruit, hung it upside down, turned the camera upside down, and as we withdrew the wires it fell apart. Printed backwards it looked like the fruit was forming into Lady Liberty. The filmmakers were pretty pleased and amazed, because it was one of those gags they first thought might be CG, but we did it practically.”

With Otis motivating the majority of the mayhem, Tippett Studio took the lead in developing animation blocking for the Rube Goldberg sequence. Otis’ contortions required an additional catalogue of look development, modeling, rigging, textures, fur and shader work to represent a variety of ‘Otis states.’ “Every week we had an ‘Otis states’ meeting,” recalled Thomas Schelesny. “We’d discuss what state Otis was going to be in – whether it would be his ‘normal’ state, with the green face and more-or-less dog proportions, or ‘Charred Otis’ when he was burnt to a crisp, ‘Cubed Otis’ where he was pulled through a heating duct and pops out in the shape of a cube, ‘Dirty Otis,’ ‘Wet Otis,’ ‘Flat Otis’ where he goes through the ringer of a washing machine, ‘Spinning Otis’ where we had three different versions of him spinning, all at the same time, inside the machine. Some of the Otis states, like Charred Otis, employed many of the same animation controls as normal Otis, but it was a highly modified model and an entirely new set of textures covering his entire body in little shards of burnt chips.”

Charred Otis, seen when Alvey dupes the dog into chewing on a bone-shaped bomb, used technology that Tippett Studio developed for effects in the martial arts thriller *The One*. “We developed an ability to break up a model into different pieces,” explained Todd Stinson. “We expanded the Otis model to the tips of his fur and used that technology to break him apart, flaking the pieces. We controlled that with a little CG sphere that we could move around, and wherever the sphere came close to the surface it broke apart the polygon mesh.” Lead effects animator Matt Hunter developed procedural flaking effects timed to work in conjunction with character animation of the dog shivering with terror as he dangled from a chandelier.

Spinning Otis required skillful manipulation of 3D renders in the compositing process. “We didn’t want Spinning Otis to be a big blur,” related Alan Boucek. “We wanted to be able to recognize him, so the technical directors, led by Steve Reding, rendered versions with different motion blur – a non-motion-blur pass, a lot of motion-blur, a little motion-blur. We mixed those in the composite, working interactively with the supervisors and experimenting with frame rates.



In pursuit of Tim and Alvey, Loki brushes aside a parking attendant and buries the man in the sidewalk with a cartoon flip of his wrist. Alan Cumming mimed the action, extending his hand into the air on the Sydney street location. The visual effects crew filmed a stunt performer executing the flip, diving into a padded floor cavity, in a greenscreen wire rig. Digital Dimension stabilized the greenscreen element and tracked the hapless man into the shot with animated 3D cracking pavement, bouncing debris, trickling dust, shadows and reflections, and then animated a tilt-down.

Spinning objects sometimes appear to strobe or spin backwards, so we controlled that by mixing different models and smoothed out non-motion-blurred frames by mixing in more of the blurred version.”

Dragged, smashed, cubed and spun, Otis is flung out of the garden, dumped in tar, pulled through a birdhouse, festooned with feathers, dragged through dirt, and shot back through a window into a tiny laundry room where he is washed and mangled to a paper-thin strip. Tar was generated by shaving fur from the Otis model using density maps, clumping remaining tufts, then generating displacements from the skin and rendering a gooey specular layer. The laundry room scene was one of the few instances in the film that involved motion control, the confines of the set requiring separate passes of flyaway walls to accommodate the camera.

Alvey re-inflates the flattened dog like a rubber glove and then releases him out the window. The scene was one of four shots in the film in which ILM’s baby shared the screen with Tippet Studio’s dog. “We had to know where the dog was before we could put the baby in,” commented Ed Hirsh. “Once they blocked the dog’s action and had that approved by Larry, we hooked our baby to the dog. Wherever it was all about the dog, Tippet scanned the shot, did the color correction and set up the shot, then sent us a firewire of their animation so we could start our process. We went back and forth a number of times sharing information.”

The duel between dog and child culminates with Loki abducting Alvey, and Alvey’s father appealing to Otis, as the wearer of the Mask, to help him win back his child. The scene featured the only instance in the film where Tippet Studio tracked its CG animated dog head to the live canine performer. “Otis was seated in that scene,” commented Jamie Price, “so we put our digital head on the live-action dog and avoided having to build a CG costume.”

Loki meanwhile bonds with Alvey in an alleyway scene that featured all versions of the baby – live, puppet and CG – decked out in a ten-gallon hat and cowboy outfit, with gunslinger motion capture performed by Tom Bertino. The sequence also featured digital and pyrotechnic effects with transitions in and out of character generated by Tippet Studio, Digital Dimension and Giant Killer Robots. “We interfaced with ILM on a shot where the baby turns into a tornado,” stated Mike Schmitt. “We built a tornado rig as a V-shaped column of overlapping tires that did a full rotation in about four frames. We used a low-rez rig in Maya to control the way the tornado bent and deformed and jumped around to give it life. We exported that into another lighting rig in Softimage XSI to apply textures to the character inside, revealing some of its



In the film’s final act, Tim Avery adopts his Mask persona and transforms the family car into a souped-up Maskmobile. Action vehicle supervisor Darren Loveday built the Mask car, from a design by Tim Lawrence, using a Holden Monaro tricked out to resemble a Tex Avery vision of a Pontiac GTO. Brian Cox’s special effects team supplied pyrotechnic effects that shot from the automobile’s rear engine and exhaust manifold, then mounted the vehicle on a hydraulic gimbal for bluescreen photography of Tim and Tonya in pursuit of Loki.

colors, from its feet to its head. Then we used mental ray's rapid blur feature to come up with nice-looking streaks with shorter render times."

ILM animation in the alley included Loki and Alvey twisted into an elongated pretzel in a surreal game of 'Super Twister.' Jamie Price and ILM shot motion control elements on the set, with Alan Cumming first enacting the scene backed by bluescreen, clad in a bluescreen suit and hood. "We decided in the beginning that we didn't want to render Alan's head digitally for closeup work," remarked Ed Hirsh. "Instead, we cloned Alan's real head onto a stretched out CG body. For where he uncoils and reverts to normal Loki, we shot the 'A' part with Alan lifting his head, anticipating his uncoiling motion. Then we shot the 'B' part with Alan in his correct costume resolving back into the normal Loki - and finally we shot a clean background plate." ILM generated a CG intermediate unwinding character with Cumming's face, and an elongated baby, lit with global illumination and subsurface scattering.

The alley scene ends with Tim Avery and his car transformed, chasing Loki and Alvey down city streets that writhe in Loki's wake. "The chase was inspired by the Road Runner racing across the desert, sending the road up behind him," noted Larry Guterman. "We transplanted that imagery to the city. I wanted the city to resemble turn-of-the-century urban New York architecture in One Froggy Evening, and found two streets in Sydney that gave us that look." Jamie Price shot the chase with a full-size Mask car, built for the production by action vehicle supervisor Darren Loveday. Brian Cox's team rigged the car with fiery engine exhaust and mounted the vehicle on a hydraulic gimbal for bluescreen interiors. ILM shot photographic surveys of Sydney buildings, built tiles of the environment and applied textures to geometry flanking a ribbon of 3D road rigged to deform and drop crumbling debris. A CG Mask car, built from photo reference, then coasted the wildly undulating tarmac.

The chase concludes in an arena tricked out for a showdown between Loki and Tim as they battle over custody of Alvey. Tippett Studio generated a matte painting of the arena exterior while Illusion Arts generated wide interior views, both companies enhancing the Sydney Olympic Stadium location with flashing signage reminiscent of old Philip DeGuard Looney Tunes backgrounds.

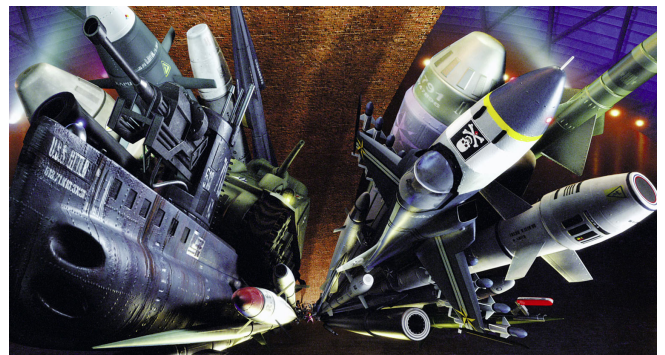
Cartoon capers escalate in a showdown containing visual effects by Giant Killer Robots, inspired by a 1953 Chuck Jones short. "Duck Amuck was where Bugs Bunny paints and erases Daffy Duck and moves him around in scenes," explained Mike Schmitt. "We looked at a lot of cartoon reference, and, before we did our own previz, visual effects editor Martin Kloner gave us 'Martymatic' animatics created in his editorial suite where Larry blocked out shots with specific framings and timings." Loki takes the form of a giant eraser-tipped pencil to do battle with Masked Tim, putting a spin on a scene from the first Mask film. "Tim pulls giant bundles of guns from his pockets, the camera pauses, and then pulls back as even bigger guns come out, with submarines, MX missiles, a tank and a jet fighter. It was one of our hardest shots because it involved so much detail, with more than 100 weapons modeled from scratch. It was like building a city."

Loki erases Tim's arsenal, replacing weapons with giant daisies. Tim counters with a pencil sharpener that grinds Loki into shavings that reconstitute into Loki's human form. GKR

technical director Toshi Otsuka used Maya particles to reverse-engineer the effect. "We first created particles that had the look of pencil shavings," explained Schmitt. "We then went backwards from the image of Loki in his leather suit and combined the two; so as the particles flew out of the pencil sharpener and spiraled down toward the floor, they inherited Loki's color as they landed on his surface."

Competing for Alvey's attention, Loki sprouts carousel animals from his head, realized as an animatronic. "It was a toss-up whether the carousel creature should be a visual effect or a practical effect," noted Keith Vanderlaan. "I figured this might be one of our last opportunities to build an effect like this, so we were very excited to be allowed to do it." Captive Audience built a waist-up puppet with a canopy that popped from its head and spun, candy canes that extended from the ears dangling toys on strings, an extending silicone jaw and mechanical protruding eyes. Five puppeteers operated Loki, including two performers playing the puppet's hands. Mechanical engineer Terry Sandin operated his glowing teeth, which lit up like a Hasbro Simon game.

Loki finally resorts to chasing Tim and Tonya with a 35-foot-long hammer, rendered digitally by Tippett Studio and timed to coincide with practical effects of imploding packing crates executed on the Sydney set by Brian Cox's team. Odin then appears from a humongous glowing vortex - a Tippett Studio soup of 15 Odin objects, glowing rings and close to 30 layers of whirling atmosphere effects and Maya particles. The film resolves with mortals and deities reconciling their differences, leaving baby Alvey happily ensconced with his mortal parents.



Competing for baby Alvey's affections in a finale set inside the Sydney Olympic Stadium, Masked Tim confronts Loki with an imposing spray of cartoon weaponry, pulled "impossibly" from his pockets. Giant Killer Robots generated 3D animation for the scene, using as reference shots of Jim Carrey producing a Tex Avery array of pistols in *The Mask*. In the Chuck Jones-inspired version, more than 100 outlandish weapons, all modeled from scratch, were tracked to live-action footage of Jamie Kennedy miming the gun-toting action.



Loki erases Masked Tim's arsenal, replacing it with daisies. The gag was a nod to the classic Chuck Jones animated cartoon, *Duck Amuck*, in which Daffy Duck suffers the whims of a prankish animator's pencil. To accommodate the shot's extreme high angle, Giant Killer Robots created a digital set extension, expanding the stadium and the cartoon-styled brick wall behind Jamie Kennedy. GKR then added gigantic daisies that wilted and dropped their petals.

ILM closed out the movie with a final baby wink, shortly followed by a manic Otis, added late in postproduction by the Tippett team, slicing up the film with a pair of shears as a final 'That's All, Folks.' "Otis is ultimately the loveable loser," commented Thomas Schelesny. "No matter how hard he tries to be evil, he is defeated by his innocence. It was very much the Chuck Jones style."



In the hyperactive showdown, Tim Avery "conceding that he is no match for the Viking god of mischief" removes the Mask, revealing his true self to his baby son. Jamie Kennedy performed all Mask scenes in Captive Audience makeup, then mimed the Mask removal sans prosthetics. Giant Killer Robots generated all Mask application and removal effects in the film, closely referencing ILM's similar work on the original and adapting that look to the sequel's Chuck Jones-inspired palette. Sequel enhancements included Alien face-hugger finger action and a shimmering green glow that foreshadowed the Mask's transforming energy.

For the first Mask, ILM provided 91 shots comprising 12 minutes of animation, with Dream Quest Images adding another 48 shots in the last leg of postproduction. Ten years later, technological advancements allowed the sequel, in ten months, to incorporate more than twice the shots and animation screen time. "The main difference between now and then is that we have a lot more capability in 3D," said Jamie Price. "Camera tracking and the general realism of 3D have come a long way. That enabled us to re-create some of the style, camera moves and blocking of cartoons from the '50s. Some of those old cartoon camera moves were crazy - high angles, tracking with a character as he's running off a cliff - and we haven't been able to do that in live-action until today, with the capabilities of

3D. The maturation of the tools has enabled us to push our style much closer to a style of animation that, until now, could only have been drawn."

If balancing style and technique remained the production's biggest challenge, an appreciation of the animated source material remained key to understanding the philosophy behind the Acme school of visual effects. "Chuck Jones' cartoons had a wicked contemporary sensibility," concluded Larry Guterman. "They had a knowing self-awareness, but they were never cynical or jaded; they retained their innocence. It was that cross between innocence and awareness that remains appealing and keeps them fresh today. I think Jamie, Susan MacLeod, Tom at Tippett, and Tom Bertino, Ed Hirsh and everyone at ILM all appreciated that. They bent over backwards for us on this movie, and I'll always appreciate that."

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